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Nursing Home Quality of Care: OBRA 1987, Competition and Demand

Virender Kumar

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Health Policy and Administration, School of Public Health

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ABSTRACT

Virender Kumar

Nursing Home Quality of Care: OBRA 1987, Competition and Demand

Edward C. Norton, Ph.D. (Advisor)

***Background*:** Policymakers are concerned with the quality of nursing home care. The Omnibus Budget Reconciliation Act of 1987 (OBRA 87) was a major legislative effort to improve quality. ***Objective*:** This study determines the effects of OBRA 87 required minimum quality standards, market competition, and Medicaid reimbursement on the quality of care and the Medicaid population's access to nursing home care. This study measures quality of nursing home care in terms of an individual resident's death as well as any of the following outcomes: bedsores, urinary-tract infection, injuries related to falls, dehydration, malnutrition, and weight-loss. Percent Medicaid residents in the facility is used to measure Medicaid population's access to care. ***Methods*:** Full-information maximum likelihood technique is used. The endogeneity of a facility's proportion of Medicaid residents and an individual's past health outcomes is accounted by using discrete factor technique that controls for common unobserved time-invariant individual- and market-level factors. Study data include observations on individuals (2,750 individuals) admitted between 1984 and 1995. ***Results*:** A higher proportion of Medicaid residents lowers the quality of nursing home care. The analysis suggests that OBRA 87 improved quality of nursing home care, while reducing access to such care for the Medicaid population. Competition among nursing homes improves access to care for the Medicaid population. ***Conclusions*:** The findings suggest

that although government-required minimum quality standards improve the quality of nursing home care, they also reduce Medicaid population's access to nursing home care. Requiring nursing home to have at least a certain percent of private payers to receive Medicare and Medicaid certification may improve quality of nursing home care. Increasing competition may improve access to nursing home care for the Medicaid population.

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TABLE OF CONTENTS

Item	Page

Item	Page

Item **Page**

LIST OF TABLES

List of Figures

Item **Page**

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

INTRODUCTION

Long-term care is an important aspect of the health care delivery system in the U.S. Public and private expenditures for nursing home care comprise a major share of expenditures on long-term care. Forty three percent of Americans turning 65 will use a nursing home at least once in their lifetime (Kemper et al., 1991). The high cost of nursing home care puts significant pressure on public as well as family budget. The quality and access to nursing home care for the Medicaid-eligible population has been a long-standing concern for consumers and policymakers.

Public funding of long-term care is directed heavily toward institutionalization, especially nursing home care, which accounts for about 12 percent of public health care spending. About four-tenths of long-term care costs are borne by federal and state Medicaid programs. The large government expenditures ($87.5 billion in 1996) for nursing home care (Harrington et al. 1999) and the persistent problem of poor quality of nursing home care (Mendelson 1974; Rebeiro et al. 1985; HCFA 1991; 1998; Berman et al. 1989; Institute of Medicine 1986; 1996; USGAO 1987; 1998; 1999; Graber et al. 1995; Hawes et al. 1997; Harrington et al. 1998; 1999) have long concerned policymakers, researchers, and other interest groups. In addition, nursing home residents are generally in a frail and debilitated condition. All of these factors combined make the quality of and access to nursing home care for the Medicaid-eligible population an important topic to study.

The Omnibus Budget Reconciliation Act of 1987 (OBRA 87) was a major government effort to improve the quality of nursing home care (Institute of Medicine, 1996; Congressional Service Report, 1988). It mandated the most comprehensive legislative requirements ever to affect nursing homes through a set of conditions for certification of all nursing homes receiving Medicaid and Medicare payments (Marek et al. 1996).

In addition to OBRA 87 regulation, other efforts on the part of the government may have an indirect bearing on the quality of care provided by nursing homes. Since 1962, the rate of growth of nursing home expenditures has been in the double digits, except in the mid 1980s when the rate fell to single digits (Holahan et al., 1987; Letsch et al., 1992; Congressional Research Service report, 1993; Yu et al., 1995). To restrain the growth of nursing home expenditures, the federal government mandated a certificate of need regulation (CON) in 1974. The effectiveness of this regulation has gradually declined in the 1990s. In addition, many states adopted construction moratorium regulations to restrict supply in the early 1980s. Further, the states improved the benefits for long-term care alternatives such as home-based and community-based long-term care and started screening people eligible for long-term care to divert those deemed to require less care away from nursing homes to alternative long-term care settings. Implementation of a new prospective payment system for skilled nursing facilities under the Balanced Budget Act of 1997 (HCFA, 1998) is another step in this direction.

Because there have been many changes in the nursing home market and the regulatory environment monitoring nursing home quality of care in the past several years, it is imperative to study the effects of these changes on the quality of nursing home care. In addition, huge nursing home expenditures have strained many states' budgets, making it

important from a policy standpoint to examine other factors besides Medicaid reimbursement rates that can improve quality of and access to nursing home care to the Medicaid population. This study proposes to examine the effects of the OBRA required increase in minimum quality standards (implemented on October 1, 1990), competition, demand, and Medicaid reimbursement rates on the quality of and access to nursing home care for the Medicaid population.

The proposed study will examine the following questions:

1. *To what extent did the OBRA 87 required increase in minimum quality standards affect the quality of nursing home care?*
2. *Does the quality of nursing home care vary with competition?*
3. *Does the effect of the Medicaid reimbursement rate on quality of nursing home care differ between excess demand and excess capacity markets?*
4. *Does the proportion of Medicaid residents in a nursing home vary with the Medicaid reimbursement rate, competition or the OBRA 87 required increase in minimum quality standards?*

Various changes in nursing home markets may have affected both quality and access to nursing home care for the Medicaid-eligible elderly population. First, the OBRA 1987 required increase in minimum quality standards may have forced nursing homes to redistribute their resources. However, this diversion of resources to care for those who would have been restrained in absence of the OBRA 87 regulation may negatively affect health outcomes like bedsores, malnutrition, weight-loss, urinary-tract infection, other infections and injuries. Over time, the government developed more stringent quality standards, better monitoring guidelines and strategies, and strict penalty rules that have

increased the likelihood of a given nursing home being caught and penalized. With the increases in the expected cost of being penalized for not abiding by government regulations, the quality of nursing home care is expected to improve in areas such as use of physical and chemical restraints. In general, government quality standards put more emphasis on structural aspects of the nursing home quality of care that may or may not have a direct bearing on the residents' health outcomes. Quality regulations have focused on inputs to care, fire safety, civil rights, and administrative procedures rather than on patient outcomes (Bishop, 1988; Norton, 2000). Fraundorf (1977) says, "There is evidence that state inspectors focus primarily upon the physical conditions of the nursing home (because it is relatively easy to evaluate) rather than make any attempt to assessing the quality of patient care." OBRA 1987 regulation also focused on increasing the RN staff, providing training to nursing, LPN and nursing aide staff, residents' rights, survey and enforcement procedures. These requirements focus on capacity and the ability to provide good care but not on the actual care. The regulation did require the government to develop a resident assessment instrument to assess quality of care. But the government has yet to come up with techniques to use these survey data to measure the effect of care on the residents' outcomes and the ways to identify facilities that are not providing appropriate care. For example, OBRA 1987 require nursing homes to employ at least one register nurse 8 hours per day but it does not ensure whether this person will be directly involved in providing care to the nursing home residents. Similarly, nursing aids training requirements do force nursing homes to have a training program but there are no procedures in place to evaluate the effects of such programs in terms of improved residents' care. But government standards do force nursing homes to divert resources to meet those standards. If the government requirements increase cost of

care without a corresponding increase in reimbursement rates, the nursing homes may be cutting back on care in other much needed areas. Therefore, it can be expected that quality in some areas may have deteriorated, especially if the government requirements divert resources away from the areas that have a direct bearing on patient outcomes. For example, the decrease in physical and chemical restraints may have forced nursing homes to employ resources to take care of these residents at the cost of less care to the other residents. The reduced level of nursing home care may reduce the private demand for such care. This will lead to an increase in the access to nursing home care for the Medicaid-eligible population.

Second, the average certified nursing facility occupancy rate declined from 92 to 84 percent between 1984 and 1997. This decline suggests that excess demand is no longer a universal problem (Nyman, 1989; Nyman, 1993; Strahan et al., 1997; Harrington et al., 1992; Cohen et al., 1993; Cohen et al., 1996). Therefore, the quality of care may have increased in some of the nursing home markets as a result of increased need to compete for residents. The effect of competition depends upon the degree to which consumers can make informed choices (Nyman, 1989). If consumers can easily evaluate products before purchase, contract over delivery terms, monitor contractual compliance and obtain redress for violations, for-profit organizations produce the socially efficient product array (Hirth, 1999). Hansmann (1980) argues that the lack of consumers' ability to evaluate some product attributes leaves an element of discretion to producers. This means that if consumers are not able to judge or monitor the quality of nursing home services or take appropriate actions in response to any problems, nursing homes, especially for-profit ones, may lower the quality to increase their profits. In such a situation, the effect of competition on a nursing home may be lower compared to if consumers were able to evaluate and monitor the quality of nursing home

services. The overall increase in the quality due to increased market competition may have raised nursing homes' cost of care. Therefore, the access to nursing home care for the Medicaid population is expected to go down with an increase in competition.

Third, although chronic disability prevalence rates have been declining over time (Singer and Manton, 1998; Manton et al., 1998), the nursing home case mix has increased due to a significant growth in alternatives to nursing home care that cater mostly to less severely impaired residents (Davis et al., 1998). Increased overall case severity may result in lower average quality of nursing home care if all else remains the same (such as staffing levels). This reduction in quality will positively affect the Medicaid population's access to nursing home care.

Fourth, increases in for-profit nursing homes in the market forces all nursing homes to be increasingly efficient. This may negatively affect the quality of care. The lack of a profit incentive may cause nonprofit firms to compete less vigorously to reduce costs (Spector et al., 1998). In addition, many researchers argue that competition from for-profit homes reduces the ability of nonprofit homes to provide higher quality of care (Weisbrod, 1988; Steinberg, 1994). According to Strahan and colleagues (1997), the proportion of for-profit nursing homes has declined from 74.9% in 1985 to 66.2% in 1995. Therefore, competitiveness in terms of efficiency in the nursing home markets may have gone down, thereby positively affecting the quality of care.

Fifth, increases in close substitutes like home health care to nursing home care over time are expected to place nursing homes in an increasingly competitive environment (Norton, 2000; Silverman 1990). The characteristics of nursing home markets match more closely with that of perfect competition compared to other health markets (Scanlon, 1980; Bishop,

1988; Zinn, 1994). The competition in the Nursing home markets has been characterized as monopolistic competition (Scanlon, 1980; Nyman, 1985; Gertler, 1989; Dusanski, 1989, Grabowski, 1998; Norton, 2000) in which there exist many buyers and sellers. Hart (1985) defines monopolistic competition as a situation where (1) there are many firms producing differentiated commodities; (2) each firm is negligible, in the sense that it can ignore its impact on, and hence reactions from, other firms; (3) free entry leads to zero profit of operating firms; but (4) each firm faces a downward-sloping demand curve and hence equilibrium price exceeds marginal cost. Product differentiation is an important component of imperfectly competitive strategic interaction (Spence, 1976). Because of the absence of advertisement in this industry, it is expected that the rise in competition will lead nursing homes to resort to differentiation in terms of services or location to attract prospective residents. They may do so by providing different level of services with varying prices. Therefore, in such markets nursing homes will compete on quality (Norton, 2000). In comparison to perfect competition, equilibrium in monopolistic competition employs too many resources. However, the competition in this sector is limited due to; 1) lack of government financing of alternatives to nursing home care reduces an elderly person's choices for long-term care, 2) prospective residents often seek care at a time of health crisis (Hing, 1987). This reduces the available time to make an informed choice, 3) poor health status and cognitive impairment restrict residents' ability to switch nursing homes, 4) The Medicaid subsidies reduce prospective Medicaid residents' incentives to weigh pros and cons of entering a particular nursing home, 5)Medicaid prices are not only lower but also fixed irrespective of a resident's care needs. Thus, nursing homes are likely to admit healthier Medicaid residents, 6) Restrictions on beds supply through CON and construction moratoria

regulations further worsen access problem. These factors impede free operations of nursing home markets. These regulations lead to excess demand that increases prospective nursing home entrants' cost in terms of making choices among nursing homes. According to Nyman (1985; 1994), excess demand reduces competition and thus, it had led to lower quality of care. In addition, the access to heavy care Medicaid population is restricted in these markets. The competition is expected to improve quality in excess capacity markets due to greater choice and reduced information costs to prospective residents. This increase in quality will raise nursing homes marginal cost of care and thus, nursing homes find marginal Medicaid residents costlier. This will reduce Medicaid population's access. The rise in competition from nursing home alternatives will have a positive effect on nursing home quality and it will negatively affect access to nursing home care for the Medicaid population.

Sixth, changes in Medicaid reimbursement methodology from retrospective to prospective or case-mix payment may have affected both the quality and access to nursing home care for Medicaid-eligible elderly individuals. The Medicaid reimbursements for nursing home care across all states can be grouped into four methodologies: Retrospective, prospective-facility-specific, prospective-flat-rate, and combination. A facility is reimbursed for all the costs incurred in the provision of care under the retrospective system. Under prospective-facility-specific method, the rates are set using facility-level costs from prior years. Similarly, prospective-flat-rate method bases the rate on the cost experience of all the facilities or classes of homes in the state, rather than the cost experience of an individual facility. The combination method reimburses homes using a combination of prospective and retrospective methods for different cost centers. Some states allow an adjustment in their prospective rates based upon the actual cost experience of the facility.

Many states reimburse facilities using the prospective method after accounting for the case severity of the residents. This method adjusts the reimbursement to each facility after accounting for the facility-level case-mix of residents. The case-mix reimbursement method increases the probability that an elderly person with higher case severity will be admitted to a nursing home. Because these methods restrict nursing home revenue from Medicaid residents to varying degrees, the quality of care is expected to vary with the reimbursement method. According to Swan and colleagues (1993), the number of states using retrospective methods fell to 1 in 1994 from 15 in 1978. There were 24 states using prospective adjusted methods in 1994 compared with only 12 in 1978, while twenty states used prospective-facility specific methods in 1994. The number of states using other methods like prospective class and combination did not change significantly between 1978 and 1994. More and more states are using case-mix reimbursement method. There were 25 states using case-mix method in 1994 compared to 19 in 1992. Cohen and Dubay (1990) found the proportion of Medicaid residents to vary depending upon reimbursement methods adopted by the state Medicaid authorities. States with a retrospective reimbursement method had facilities with the highest proportion of Medicaid residents followed by states with prospective facility-specific reimbursement methods. States with prospective reimbursement methods had facilities with the lowest proportion of the Medicaid residents. Overall, quality of nursing home care is expected to improve with the increase in reimbursement levels in low demand areas while it is expected to decrease in high demand areas. The access to nursing homes care for the Medicaid population will decline in low demand areas and will improve in high demand areas.

To answer the questions raised above, this study employs a system of equations using discrete factor models to estimate the probability of any of the discrete negative health outcomes (the quality measure used in this study), as functions of individual, facility, market and state characteristics. This study includes observations on individuals 65 years and older who were admitted to a nursing home between March of 1984 and July of 1995. None of the sampled individuals appear twice in this study. Access to nursing home care is defined here as the relative likelihood of entering a nursing home for a Medicaid covered elderly person compared to that of a private paying elderly person. Medicaid population's access to a nursing home care is measured in terms of the percent of Medicaid residents in the facility to which the sampled individual was admitted. In the excess demand case, this measure is easy to interpret—if the percent Medicaid residents in a nursing home goes up then it indicates that the nursing home is replacing private residents with Medicaid covered residents. If the percent Medicaid residents in a nursing home goes down then it indicates that the nursing home is replacing Medicaid residents with private residents. But this measure also poses problems in terms of assessing the changes in Medicaid covered population's access to nursing home care if *a priori* we can not say whether total number Medicaid residents will increase or decrease. But if we know *a priori* the direction of change in total Medicaid residents, this measure can be assumed as an indicator of relative likelihood of entering a nursing home for Medicaid covered elderly compared to that of a private paying elderly. Past studies found that nursing home quality of care is inversely related to its proportion of Medicaid residents (Fottler et al. 1981; Lewis et al. 1985; Weissert et al. 1985; Nyman 1987; Zinn 1994). In this study, it is hypothesized that a nursing home simultaneously chooses the number of Medicaid versus private residents to

admit and the level of quality of care to deliver. It is also hypothesized that there are common unobserved individual-level and market-level characteristics that affect an individual's likelihood of dying as well as encountering any of the negative outcomes studied here. Analyses in this study accounts for individual-level and market-level heterogeneity using the discrete factor method to solve a system of simultaneous equations.

This study uses data from Medicare claims part A and B files, OSCAR, ARF, National Death Index file and the State Characteristics of Long-term Care Programs (Bedney et al., 1995, Harrington et al., 1990 to 1998) from 1984 to 1995 to examine the effect of OBRA 87 regulation, market competition, Medicaid reimbursement rates, and market demand on the quality of and access to nursing home care on the Medicaid population. The study uses observations on individuals sampled for National Long-term Care Surveys (NLTCS) because NLTCS surveys elderly people who are at high risk of nursing home use and because it can be linked to Medicare claims data.

To my knowledge, this study is the first to examine the effect of the part of the OBRA 87 regulations implemented in 1990 on quality of nursing home care using residents' health outcomes as quality measures. In addition, the study findings will provide policymakers with insight into the workings of nursing home markets. The study will provide an evaluation of market characteristics such as competition and demand levels that can be used as strategic tools to improve the quality and access to nursing home care without further straining government budgets.

BACKGROUND, LITERATURE REVIEW AND SIGNIFICANCE

This section provides a brief overview of nursing homes in the US, their quality and market area, and the diseases most commonly contracted in the nursing homes. The word contracted is defined as the diseases that are actually developed in the facility but can be prevented. The list of diseases mentioned is not comprehensive. There are other problems such as weight loss and falls that are not listed in that section. Diseases like cancer, diabetes, heart disease, and malignancy cannot be attributed to nursing homes care. But these diseases predispose an individual to infections that can be prevented to a great extent by adopting appropriate procedures. In addition, it reviews the past literature on how government forces, the market and nursing home characteristics affect the quality of nursing home care. This sections ends with a discussion on the policy significance of this study.

Nursing Home Care and Population

Nursing homes provide custodial or rehabilitative care to people with chronic or terminal illnesses or impairment. Conceptually, skilled nursing care and custodial care are quite different, and the two are reimbursed at different rates. In 1990, however, the government stopped distinguishing between skilled nursing facilities (SNF) and intermediate care facilities (ICF), so this study considers all nursing facilities.

In 1997, there were 15,661 certified nursing facilities with 1.6 million beds and 1.37 million residents (Harrington et al., 1999). Most of these residents were elderly. A majority of nursing home residents tend to be severely impaired and heavily dependent on others to carry out their daily activities. Approximately 48 percent of nursing home residents have dementia, 83 percent are extremely impaired, and another 14 percent need help with at least one of the activities of daily living (HCFA 1998). About 70 percent of nursing home and

personal care home residents are women and a majority of them are widowed or divorced. Because most of the elderly entering nursing homes tend to be frail, poor in health and single, it becomes difficult for them to choose a nursing home based on quality or to raise their voices against poor quality of care.

Nursing Home Markets

Health care markets have been defined in terms of geopolitical areas such as standard metropolitan statistical areas (SMAs) or counties, resident origin, or fifteen-fifty mile radii (Garnick et al., 1987). Defining the precise market area requires very detailed information on all the facilities and their residents, information which is often difficult to obtain. In addition, most of the socio-demographic and economic information is available at the county, SMA, or state level, which makes it difficult to define markets on other bases. Morrisey and colleagues (1988) used the Little In From Outside (LIFO) and the Little Out From Inside (LOFI) rule. They defined an area to be the market if a given percent of residents in that area were receiving treatment within the area. But because the cutoff point was arbitrarily decided, this may not be an appropriate way to define markets. Zwanziger and Melnick (1988) proposed a market definition that takes into account the fringe suppliers and defines hospital- and service-specific market areas. In their approach, a hospital is considered to be in competition for a given service category or for all services, if it drew at least three percent of the residents from a given zip code area. Other authors like Robinson and Luft (1985), Robinson (1988), Garnick and colleagues (1987) use the fifteen-mile rule. Russel (1979) used Standard Metropolitan Statistical Areas to define markets. Most of these definitions are arbitrary and may not represent the true market for a nursing home.

Many researchers have found that a majority of the residents in a given county receive services from nursing homes located in the same area (Gertler, 1989, Nyman, 1985). Gertler (1989), Nyman (1987), Joskow (1980), Spector et al. (1998) and several other authors used the county to define the market in their studies. Because federal block grant funds for long-term care services are distributed at the county level and most states use the county as a unit in their planning and funding policy decisions, this study uses the county as a market for a given nursing home's services.

Nosocomial Infections

Nosocomial infections in the nursing homes are those infections that either develop in the nursing home or are produced by micro-organisms acquired during an individual's stay in the nursing home (Smith, 1984). The outcome of such infections may range from simple fever to septic shock or death. Any existing open wound or skin infection becomes a site for local as well as systematic spread of infections. Diseases and disorders like diabetes, heart disease, dehydration, immobility, malignancy, and malnutrition that themselves are not infections predispose individuals to infections. The list of diseases mentioned is not comprehensive. There are other problems such as weight loss and falls that are not listed in this section but such problems can occur due to poor quality of care. Diseases like cancer, diabetes, heart disease, and malignancy cannot be attributed to nursing homes care. But these diseases predispose an individual to infections that can be prevented to a great extent by adopting appropriate procedures. Some of these infections are discussed here.

Skin Ulcers

Skin ulcers develop when cells are lost more quickly than they can be replaced. Skin ulcers are not only painful but can lead to septicemia and mortality. Elderly people are predisposed to such ulcers due to the thinning of the skin with age. Other factors that increase the likelihood of skin ulcers are physical and/or chemical restraints, diseases in the arteries or veins, vascular and nervous system diseases (stroke), immobility, incontinence, vitamin deficiency, dehydration, malnutrition, diabetes mellitus, alcohol abuse and any damage to the central nervous system. Elderly people with altered mental status are at greatest risk of developing skin ulcers. Skin ulcers may be prevented by frequent rotation of the patient and observation of the affected body parts.

Urinary Tract Infections

The term urinary tract infection includes urethitis, cystitis (bladder infection) and pyelonephritis (kidney infection). Urinary tract infections increase with age and are more common among women than men. An individual with diabetes, prostate enlargement, urethral stricture and neurogenic bladder is predisposed to having urinary tract infections. The presence of an indwelling urinary catheter and instrumentation increases the likelihood of an individual developing such an infection. Immobility, dehydration and incontinence are also associated with urinary tract infections. These infections may be prevented with good and appropriate care.

Other Infections

Pneumonia is an inflammatory process in the lung parenchyma. Complete bed rest, immobility or crowding all predispose individuals to pneumonia. Diseases like emphysema, gram-negative rods in the throat, influenza, chronic obstructive pulmonary disease (COPD),

diabetes mellitus, heart disorders, parkinsonism, malnutrition, AIDS or HIV, or degeneration of the central nervous system enhance the likelihood of an elderly person developing pneumonia.

Influenza is an acute and usually self-limited febrile illness caused by infection with influenza type A or B virus. Influenza can be prevented with immunization or by amantadine. People with heart diseases are prone to the lower respiratory tract infections. Staphylococcal infections occur more prominently in elderly people with diabetes mellitus or renal failure.

Septicemia is the presence of positive blood cultures and signs of systematic infections. Cancer patients are susceptible to septicemia. Urinary tract infections, pneumonia or other localized infections are associated with septicemia.

Diarrhea in the nursing home is caused by either the ingestion of contaminated food or spread person-to-person by the fecal-oral route. Factors that contribute to outbreaks include improper holding temperatures for food, inadequate cooking of food, contaminated equipment, and poor personal hygiene of food preparers.

Conjunctivitis is transmitted via person-to-person or via medical instruments. Symptoms include a red and painful eye associated with a scratchy foreign body sensation. Proper hand washing and handling of instruments and infected secretions can prevent conjunctivitis from spreading.

Cellulitis

Cellulitis is an infection of the skin. Moisturized skin enhances the likelihood of this infection. Diminished pain sensitivity and decreased mental status with age can hamper early diagnosis of diseases among the elderly.

Quality of Care

An organization's quality is a multi-dimensional construct, which can be measured by structure, process, and outcomes (Donabedian, 1966; 1969;1988). Structure refers to the characteristics of the facility in which care is provided. It encompasses facility size, layout, and design. Process refers to the way the care is delivered. It includes all the choices such as handling of residents, clinical paths followed, and methods used to deliver care. Outcomes measure the effect of the care on the health and well being of residents. Structural measures of quality assure that the potential to provide care is in place. Process measures of quality look at the appropriateness of care provided. Process measures lack objectivity due to the problem of after-the-fact evaluation. The inferences about the appropriateness of actions taken in the past are made based on the facility records. Because these records do not provide all the facts, it becomes difficult to pass any judgement objectively. Outcome measures of quality have a great deal of appeal but are hard to measure in general. This difficulty in measuring outcomes has been ameliorated to a great extent by HCFA's current data collection efforts. For example, HCFA's online resident assessment instrument (minimum data set) periodically collects information on residents' up-to-date health status and diagnoses. Among structure, process and outcome measures, outcome measures are considered the best indicators of quality of nursing home care (Davis, 1991). In addition, many studies find that structural and process indicators are correlated with outcomes (Weissert and Scanlon, 1985; Linn et al., 1977; Spector and Takada, 1991). Care is called good to the extent that it contributes to a resident's health and well being (Ginsburg et al., 1988). In this study, quality is measured in terms of an individual's outcome during his/her nursing home stay.

In the past, researchers used various measures of quality. Some studies used violation of regulatory enforcement measures as a quality indicator (Davis et al., 1994; Nyman, 1985; 1988; 1989; Weisbrod and Schlesinger, 1985). Such measures of quality ensure that nursing homes are meeting the government-set minimum but do not measure the actual quality of care provided. Use of regulatory violations as a measure of quality of care in comparing facilities across different states has limitations. First, the states vary in their extent of enforcing and monitoring facilities (Harrington et al., 1999). Second, the predictability of a state agency's monitoring schedule varies from state to state in ways that affect nursing home agency preparedness (HCFA, 1998). Third, the extent and intensity of monitoring may be related to the number of violations. In addition, the enforcement and monitoring intensity may vary within the state due to various reasons (e.g. competitiveness in the industry). Because cost and input intensity as measures of quality do not differentiate between efficiency and effectiveness, they may lead to spurious results. Various studies have used facility size, cost, number of registered nurses and nurse aides as quality measures (Davis, 1993; Cohen and Dubay, 1990; Lee and Birnbaum, 1983; Lee, Birnbaum et al., 1983; Bishop, 1983; Mckay, 1989; Fottler et al., 1981; Ullman, 1987; Nyman, 1988). Studies that used non-staffing measures of quality did not find any relationship between cost and outcomes (Schlenker and Shaugnessy, 1984; Nyman, 1988). Ullman (1985) used a combination of measures to come up with a single rating measure of quality. Very few studies looked at outcome measures of quality (for exceptions see (Spector et al., 1998; Porell et al., 1998; Chou, 1998; Grabowski, 1998; Cohen and Spector, 1996; Zinn, 1994; Norton, 1992)). Outcome measures are considered the best indicator of quality and, since the late 1960s, researchers have advocated their use to measure the quality of nursing home care

(Andersen et al., 1969). In this study, the quality of care is measured in terms of sampled individuals' incidence of any of the health outcomes such as bedsores, urinary-tract infections, dehydration, malnutrition, weight-loss, and/or any injury-related to falls within six months while in the nursing home. Harrington et al. (1998) cites urinary incontinence, weight loss, infectious disease, decubitus ulcers among the negative outcomes that occur in nursing homes. Injury, falls, urinary tract infections, weight loss, dehydration, and pressure ulcers are part of quality indicators developed and tested by researchers at the University of Wisconsin-Madison to assess quality of nursing home care (Zimmerman et al., 1995).

Government Oversight, Market Forces, and Nursing Home Characteristic Affecting Nursing Home Care

How Government Oversight Affect Quality of Care

Public interest in the quality of nursing home care has persisted since the mid-1950s (Spector and Mukamel, 1998). But since the enactment of Medicare and Medicaid in 1965, government involvement in regulating nursing home services has increased. A variety of reasons warrant government intervention in the nursing home markets, which in turn affects quality of nursing home care and access to such care for the Medicaid-eligible elderly population. First, the absence of third party long-term care insurance due to the problems of moral hazard adverse selection, high administrative costs involved in offering such insurance, Medicaid crowding out and nondiversifiable intertemporal risk (Norton, 2000) leaves no alternative to government funding (Norton and Newhouse, 1994). Further, availability of Medicaid long-term care insurance itself may have prevented employers from offering such insurance (Norton and Newhouse, 1994), discouraged saving by households with low expected lifetime income (Hubbard et al., 1995), decreased demand for such

insurance, decreased elderly savings, caused some elderly parents to transfer wealth to their children and others, or decreased informal care and increased use of formal care (Sloan et al., 1996). These factors increase government expenditures. In 1994, the federal government paid 57 percent of the $71 billion annual nursing home care expenditure (HCFA, 1998). Long-term care accounts for about 35 percent of Medicaid costs, and a majority of this is spent on elderly care (Rowland, 1995).

Government involvement in regulating nursing home industry grew from a limited focus on safety in the 1960s to today's more elaborate health standards. To contain spiraling growth in Medicaid expenditures for nursing home care, the government introduced the National Health Planning and Resources Development Act of 1974 (P.L. 93-641), which established the certificate-of-need program (CON), and many states initiated adoption of moratoria on all nursing home bed growth in the early 1980s (Harrington et al., 1994). Although the federal government repealed the CON mandate in 1986, a majority of the states still have this program in place for Long-term care (Harrington et al., 1997). The CON and construction moratoria may have led to excess demand and a decrease in competition, which in turn reduced incentives for nursing homes to improve quality. For the same reasons, these laws reduced access to nursing home care for Medicaid supported individuals, especially those with heavy care needs. The introduction of programs to screen the Medicaid-eligible elderly away from nursing homes toward alternate settings such as home health and group assisted living (Cohen and Spector, 1996) was an added attempt to control expenditures. This program may have increased competition and average severity level, which in turn may have affected both quality of nursing home care and access to such care for the Medicaid population. To limit utilization of nursing home services by the Medicaid-eligible

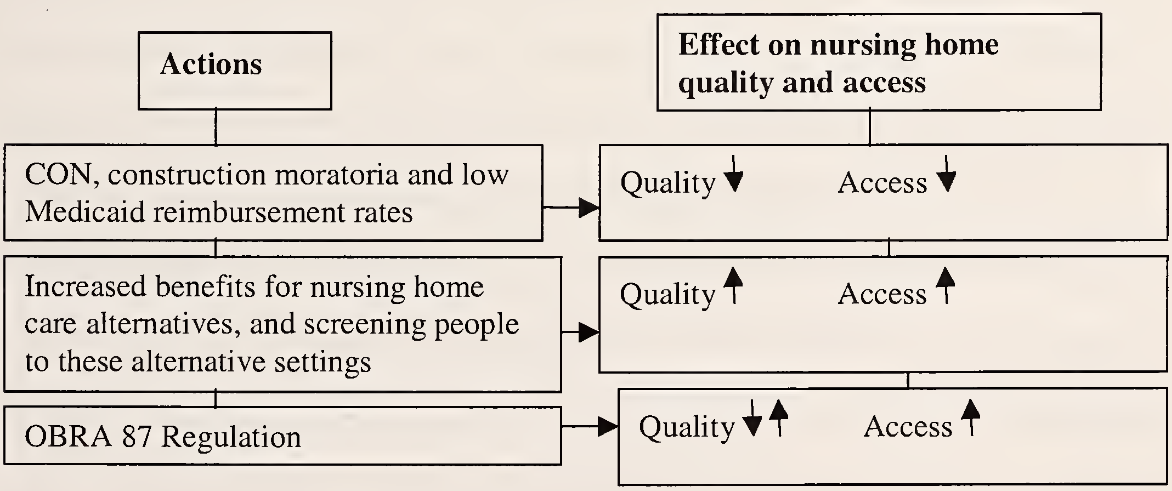
population, Medicaid reimburses nursing homes at a rate well below that of the private pay rate (HCIA, 1996). These actions resulted in restricted access to nursing home care for Medicaid-covered elderly people (Kenny et al., 1991; Gruenberg et al., 1982; Ettner, 1993).

Second, evaluating the quality of nursing home care is not an easy task, especially for elderly individuals who are frail and disabled in general. This problem is further exacerbated in the markets facing excess demand, which eliminates an important quality measure: the occupancy rates (Nyman, 1985). Lower occupancy may indicate poorer quality. To ensure appropriate quality levels, the government requires nursing homes participating in Medicare and/or Medicaid to comply with federal regulations. To ensure nursing home compliance with federal participation requirements, the Health Care Financing Administration (HCFA) arranges surveys of nursing homes with state agencies. Under the law, a statewide average interval between successive surveys must be no more than 15 months.

Third, persistent poor quality of nursing home care forced the government to commission a study by the Institute of Medicine (IOM) Committee to find ways to improve the nursing home quality of care (Institute of Medicine, 1986). Many of the IOM recommendations became part of the Omnibus Reconciliation Act in 1987 (OBRA 87), a major step in the federal regulation of nursing homes quality of care. This legislation established new standards for quality, a set of resident rights, a system to assess the quality of nursing home residents' lives, and a new survey mechanism focused on resident outcomes. The law requires new staffing and training requirements for nursing home staff. It also established new, more flexible enforcement rules and penalties to help identify and punish nursing homes that violated the new rules. The development of the Resident Assessment Instrument (RAI) was part of this act. This includes a standard assessment instrument, the

minimum data set (MDS). Most of these changes were implemented in October 1990. In general, these government quality standards put more emphasis on structural aspects of nursing home quality of care that may or may not have direct bearing on the resident outcomes. At the same time, government standards may have forced nursing homes to divert resources to meet those standards. To the extent that government requirements increase the cost of care without a corresponding increase in reimbursement rates, the nursing homes may respond by cutting back on care in other much needed areas. Increased minimum quality standards may have enhanced quality in certain areas while diminishing it in other areas. Similarly, this regulation may have affected the Medicaid population's access to nursing home care.

The effects of various government actions on the quality of nursing home care and access to nursing home care for the Medicaid population is summarized below.



How Market Forces Affect Quality of Care

Market forces like competition and demand in nursing home markets may significantly affect the quality of and access to nursing home care for the Medicaid population.

Excess Demand

A market is said to face excess demand if the number of people seeking nursing home services at the going market rate is greater than the number of beds available to provide these services. Excess demand for nursing home services was the prevailing paradigm in analyzing nursing home quality of care in the past. In general, however, the markets faced such conditions at least in part because of the states' efforts to constrain medical spending by restricting bed supply and reducing reimbursements for nursing home care.

Scanlon (1980) and Nyman (1989) provided evidence of excess demand in nursing home markets. Scanlon (1980) used two tests to examine the presence of excess demand. In the first test, he found that an unfilled bed did not affect private demand, but did increase total utilization. This suggests that nursing homes first satisfy private demand and then fill the rest of their beds with the Medicaid population. In the second test, he found no change in total utilization as a result of any changes in Medicaid eligibility. This means that Medicaid reimbursement rates are so low as to clear the Medicaid-eligible market. Nyman (1989) used a three-part test to establish the existence of excess demand. In the first test, he found the coefficient on the bed variable to be approximately one in the total nursing home services utilization regression model. This suggests that the market demand for nursing home care is at least equal to the market supply. In the second test, he found that the probability of an unfilled bed being filled by a private-pay patient was less than the probability of a private-pay patient being admitted on a first-come first-serve basis. In the

third test, he found that the variables indicating the need for nursing home care had positive sign in the private-pay utilization equation, while these had negative sign in the Medicaid-eligible utilization equation. This suggests that the private residents are preferred over Medicaid residents and that excess demand for nursing home care is due to the excess Medicaid demand.

In the past, the lack of long-term care alternatives, excess demand for long-term care, and lower Medicaid reimbursement rates provided no incentives to nursing homes to provide higher quality of care. Presence of excess demand in nursing home market indicates that the markets are not clearing. Nursing home markets do not clear for the following reasons: First, demand for nursing home services has been inflated by the subsidies provided by the Medicaid program which alter the price of care. These subsidies reduce Medicaid recipients' responsiveness to price. In addition, the spend-down requirement to be eligible for these subsidies also reduces the price elasticity of private paying nursing home care consumers. This means that the changes in price of care will have no effect on the demand for care from the Medicaid eligible persons, and these changes will also not affect the private pay demand significantly. Second, the Medicaid price is set by the state and it is lower than the private price. This price does not always reflect the actual cost of care provided by the nursing homes. Third, a profit-maximizing nursing home will discriminate between the private paying consumers and the Medicaid eligible consumers due to the differences in the prices paid by these two groups. A profit maximizing nursing home will provide services to private consumers to the point where the marginal revenue from the last private resident equals the marginal cost of providing services. The Medicaid covered residents are provided services to the point where marginal cost equals the Medicaid reimbursement rate. Because the

Medicaid prices are preset, there is no mechanism that ensures that nursing homes markets will be in equilibrium (demand equals supply). In the short run, if the bed supply falls short of demand, a nursing home will first fill the beds with private paying residents, and any remaining beds will be filled by the Medicaid population. In the long run, new homes will enter the market as long as the average revenues are higher than the average costs. But the entrance of a new home will reduce private demand and thus the average revenues for a given nursing home. Therefore, if the Medicaid reimbursement is not high enough, the supply of nursing home care will fall short of demand. This results in markets not clearing. This situation can also arise if the government restricts the beds supply through certificate of need laws or construction moratoria. In such an event, a nursing home may resort to lowering quality and restricting the access to heavy care consumers. Thus, it may reap heavy profits.

In excess demand markets, providers compete on quality to attract private paying residents only (Scanlon, 1980; Nyman, 1985; Dusanksy, 1989; Gertler, 1989; Gertler, 1992; Gertler et al., 1992; Norton, 1999). Meanwhile, low Medicaid reimbursement rates reduce quality as a result of reduced staffing intensity (Cohen and Spector, 1996; Holahan and Cohen, 1987; Cohen and Dubay, 1990; Lee et al., 1983). Remarkably, increases in the government reimbursement levels lead to poor quality (Nyman, 1985;1988;1988; Gertler, 1989;1992; Gertler et al., 1992; Norton, 1999) because this raises the opportunity cost of increasing quality to attract more private customers. On the other hand, Nyman's (1985) model and study (1989) show that increases in Medicaid rates will improve nursing home quality in markets facing excess capacity.

Because the quality of nursing home care is expected to be higher in excess capacity markets than in excess demand markets, it is important to incorporate market-level demand into the model. In addition, it is also possible that a nursing home in a market facing excess demand may be operating at excess capacity or a nursing home in a market facing excess capacity may be operating at full capacity. These differences in demand at the market level and the nursing home level can be attributed to differences in quality provided by the nursing home under consideration vis-a-vis other nursing homes in the market. In addition, there may be some unknown factors at the market level that lead to such differences. Therefore, this study uses a special technique to account for unobserved market-level heterogeneity that affects the level of quality provided by a nursing home.

Competition

In perfectly competitive markets, a rational and well-informed consumer chooses among competing providers on the basis of price and quality. Providers in turn will minimize costs and choose appropriate combinations of price and quality. In a market, the competition is said to be monopolistic if there exist many buyers and sellers, and the providers differentiate their product through advertising or services. Because providers in the nursing home industry set prices for their services provided to consumers paying on their own and choose the level of quality of their services, the competition in this industry is characterized as monopolistic.

Increase in competition will shifts the private demand of a nursing home left. Therefore, a nursing home is expected to increase quality to keep its current higher paying private residents or to attract other nursing homes' residents. In the past, persistent excess demand in nursing home markets reduced the effect of market competition on the quality of nursing

home care. Excess demand affects the quality of nursing home care and access to such care negatively (Lee et al., 1983; Holahan et al., 1987; Zinn, 1994). But excess demand is no longer a universal problem in the nursing home market, according to studies by Nyman (1993), Cohen and colleagues (1996), Strahan and colleagues (1997), and Harrington and colleagues (1992).

The transition of some of the long-term care markets from excess demand conditions to excess capacity conditions can be attributed to the tremendous growth in alternative sources of long-term care such as home- and community-based services and home health services. The growth in long-term alternatives is due to improved Medicaid and Medicare benefits for such services, to elderly people's preferences for receiving long-term care at home, and to people having negative experiences with nursing home care. The introduction of pre-admission screening programs as a gateway for Medicaid-eligible residents in need of long-term care diverts many away from nursing homes into less expensive community-based care (Cohen 1996), further constraining the demand for nursing home care. Nyman (1993) used the same three-part model that he used in his previous study (Nyman, 1989) to retest the existence of excess demand. He found weak support for the existence of excess demand in one out of the three states and he did not find any evidence of excess demand in the other two states.

Excess demand is no longer a universal problem in the nursing home market. This fact is further supported by many studies (Cohen et al., 1996; Strahan, 1997; Harrington et al., 1992). Strahan (1997), in her analysis of the 1995 National Nursing Home Survey (NHHS), reported that nursing homes operated at about 87 percent capacity. Over the 1985 to 1995 period, the number of nursing homes decreased by 13 percent while the number of beds

increased by 9 percent. In addition, Harrington and colleagues (1992) found that the number of nursing home beds per thousand elderly were on decline in the 1980's and it varied across states from 26 to 85 beds per thousand elderly population. A similar pattern in nursing home occupancy rates was seen with rates varied from 74 to 97 percent. Concurrent declines in occupancy rates and supply of beds indicate that competition in nursing home markets has increased over time. Nyman (1987, 1989) found fewer licensure code violations in nursing homes located in excess capacity markets.

Strahan (1997) reported that between 1985 and 1995 the number of for-profit nursing homes declined by 23 percent while the number of non-profit nursing homes increased by 13 percent. The proportion of nursing homes operated by chains increased from 41 percent to 54 percent during the same period. Reduction in the proportion of for-profit nursing homes in the market has two implications. First, researchers have found that for-profit nursing homes tend to provide poorer quality compared to their non-profit counterparts (Chou, 1998) and the number of for-profit nursing homes has been declining over time. According to Hirth (1999), under certain conditions along with assymetric information, competition from nonprofit organizations leads to an improvement in quality among for-profit organizations even if there exists no difference in quality among organization by ownership status. Second, because the competition from for-profit nursing homes tend to increase efficiency in the market, a reduction in the number of for-profit nursing homes may have reinforced the effect of an overall increase in competition on quality and access to nursing home care for the Medicaid-eligible population. Therefore, the quality of nursing home care should have improved as a result of a reduction in the proportion of for-profit nursing homes in the nursing home industry.

In summary, the excess demand for nursing care is not a problem in all markets, and the level of competition and demand has changed over time. These factors have a direct bearing on the quality of nursing home care delivered to residents and access to nursing home care for the Medicaid population. This study will examine the effects of competition on the quality of nursing home care and population, and whether these effects vary with the level of demand.

How Nursing Home Characteristics Affect Quality of Care

Nursing home characteristics such as size, input resources or ownership type have been found to affect quality of care. If economies of scale and scope exist in providing nursing home care, the quality per unit cost should increase with facility size. Studies by Nyman (1988; 1988), Riportella-Muller and colleagues (1982), Greenwald and Linn (1971), Fottler and colleagues (1981), and Ullmann (1981) found a mixed relationship between size and the different quality measures used in these studies. Higher registered nursing staffing levels are found to be associated with positive health outcomes (Braun, 1991; IOM, 1996). Davis (1991) concluded that nonprofessional staff-to-resident ratios appear to contribute little to the quality of care in comparison with RN or professional staff-to-resident ratios. However, he argued that this relationship may have been be confounded by the level of skilled care provided by the facility. Many studies suggest that costs and quality are positively associated when labor resources and service inputs are used as proxies for quality (Nyman, 1988; Birnbaum et al., 1981; Lee and Birnbaum, 1983). Duffy (1988) and Nyman (1988), however, reported a negative relationship between costs and regulatory compliance. These studies indicate that the relationship between costs, facility size and outcome measures have

remained unresolved. This study will control for facility-level characteristics such as proportion of Medicaid residents.

Due to variation in the incentives by ownership type, for-profit nursing homes are expected to minimize costs by providing lower quality and/or by utilizing resources more efficiently. The research findings on these issues remain unresolved. Past studies found lower expenditures in for-profit nursing homes (Davis, 1993; Nyman, 1988; Birnbaum et al., 1981; Ullmann, 1984; 1985). On the other hand, Nyman (1988) and Ullmann (1987) found no relationship between ownership type and quality. Studies by Chou (1998) and Spector et al. (1998) suggest that nonprofit homes provide better quality in terms of reducing mortality and bad health outcomes. This study will control for the effect of ownership type.

Past Research on the Effects of OBRA 87 Regulations

There are very few studies to date that examined the effect of OBRA 87 regulation on the quality of nursing home care. What studies there have been are limited in many aspects from providing a full view of the effects this regulation has on quality of nursing home care. Further, none of the studies looked at the effect of this regulation on access to nursing home care for the Medicaid population.

Studies evaluating the effects of the Resident Assessment Instrument (RAI) had mixed findings. These studies suggested that the introduction of this instrument reduced hospitalizations (Mor et al., 1997) and increased some negative outcomes while decreasing others (Phillips et al,. 1997). In addition, it reduced the use of indwelling and urinary catheters, and increased good care practices (Hawes et al., 1997). Further, out of the eight health conditions studied by Fries and colleagues RAI reduced the prevalence of dehydration and stasis ulcers (1997). Ouslander (1997) and Schnelle (1997) point to limitations in the

studies' evaluation designs. Whether these studies represent the effect that OBRA 87 regulation had on quality is questionable. These studies lack appropriate control group to evaluate the effect of OBRA 87 regulation. The timing of control group observations' coincides exactly with the timing of OBRA 1987 implementation. Authors of these studies suggest that their findings represent the effect of RAI. But their results may have been confounded by other factors like the increases in the intensity of facility surveys.

Semla and colleagues (1994) find that OBRA 87 lowered the overall use of antipsychotic drugs (Siegler, 1997), while it had very little if any effect in reducing the use of this drug for nursing home residents with symptoms appropriate for using this drug. The results from these two studies can not be generalized. Siegler and colleagues analyzed data on three nursing homes, while Semla and colleagues used data from one nursing home. The drug use was studied over twelve months on the same subjects (Siegler, 1997). This study did not control for the confounding effects of other factors such as the fact that many of the residents might have recovered and no longer required use of the drug. In addition, OBRA 87's effects were studied within six months of its implementation. Therefore, the results do not represent long-run permanent effects of this regulation. Finally, this study did not account for the clustering effect. The Semla and colleague study had similar limitations.

OBRA 87 regulation increased the focus on residents' rights, improved quality of nursing home care, reduced restraint use, and increased staffing levels in nursing homes (Marek et al., 1996; 1996). Marek surveyed 56 nursing home residents and 132 professional and non-professional staff in six states. However, her results presented mere opinions of small sample from six states. In addition, her findings cannot be generalized. Additionally, nursing home residents who can communicate well are more likely to receive better service

than residents who cannot communicate as well. Most of the other respondents might have vested interests with obvious responses and need to be interpreted with caution. Therefore, it is not a scientific validation of the consequences of this regulation.

Policy Significance

The quality of and access to nursing home care for the Medicaid population are issues of great concern to policymakers. From a policy standpoint, the Medicaid reimbursement rate is an important policy tool for improving quality and access to nursing home care for the Medicaid population. But any increase in the Medicaid reimbursement rate inevitably strains already overburdened federal as well as state budgets. This study will have implications for an important policy question—What other tools besides the Medicaid reimbursement rate can be used to improve the quality of nursing home care and access to nursing home care for the Medicaid population? Competition forces firms to produce the best combination of quality and costs. Therefore, it becomes important to examine the effects of competition on quality of nursing home care.

This study attempts to investigate whether the effect of these factors on quality varies with market demand conditions. Because market competition, demand levels and the Medicaid reimbursement rate affect the Medicaid population's access to nursing home care, this study also examines the effects of these factors on this important policy issue. If this study finds that the quality and access to nursing home care varies with competition and reimbursement rate differently at different demand levels, then it can be concluded that designing a universal policy to improve quality is not a good strategy. Therefore, it is

necessary to design an individual market-specific strategy for improving care in nursing homes and managing access to such care in that market.

In addition, OBRA 87 was a major government attempt to improving nursing home quality of care. Therefore, it is essential to examine its effects on the quality of nursing home care. To my knowledge, this study will be the first to examine this issue using residents' health outcomes as quality measures. If this study finds that quality of nursing home care is negatively affected as a result of OBRA 87 regulation then it becomes important from a policy perspective to make appropriate amendments.

CHAPTER TWO

CONCEPTUAL FRAMEWORK OF NURSING HOME EQUILIBRIUM QUALITY LEVELS

Scanlon (1980), Nyman (1985), Dusanski (1989), Grabowski (1998) and Norton (2000) developed a model to examine the effects of Medicaid reimbursement and market competition on the overall quality of nursing homes in the excess demand as well as excess capacity markets. In this section, this model is extended to include a fixed cost component (q_0) incurred by nursing homes to satisfy the government-required minimum quality standards. Here, it is assumed that nursing homes will provide additional quality (s) above minimum quality standards to attract private paying residents in all markets, and Medicaid residents in low demand markets. This extended model analyzes the effect of Medicaid reimbursement rate, market competition, and the government required minimum quality standards on the additional quality of and access to nursing home care for the Medicaid population.

CONCEPTUAL FRAMEWORK

Nursing home care providers face three types of consumers—private paying (paying either out of pocket or through private insurance), Medicaid-covered and Medicare-supported residents. Medicare and private insurance supported residents constitute a small portion of the nursing home population (Levit et al., 1994). Medicare residents are not distinguished

from private residents for the current analysis. Therefore, in the model developed in this study, nursing homes face two type of consumers: private and Medicaid. Scanlon (1980) and Nyman (1985) used such dual-market models to analyze the supply of quality of nursing home care. Private-paying residents incur significantly more out-of-pocket expenses, so they are expected to have a downward sloping demand curve. On the contrary, Medicaid residents pay very little if any out of their pockets, so they are expected to have a perfectly elastic demand curve. A majority of the state Medicaid programs reimburse nursing homes at a rate that depends on historical costs (Congressional Research Service, 1993) and this rate is lower than the rate charged to private residents. To maximize revenues, nursing homes prefer to serve higher-paying private residents first, until marginal revenue falls below the Medicaid reimbursement rates. Then, they will serve government-covered residents until the marginal cost of providing care equals the reimbursement rate.

In excess demand markets, the elderly Medicaid population finds it hard to gain admission to nursing homes. A profit maximizing nursing home does not consider quality in its production of services to attract such residents. Rather, in excess demand markets providers will improve quality only to attract private paying residents. In such markets, existing nursing homes face the risk of losing their private-paying residents with the entry of new providers in the market. Therefore, nursing homes are expected to improve quality due to the entry of a new provider in the market to keep current private paying residents, attract private paying residents from other providers and increase private paying residents' demand in the market as a whole. On the contrary, in excess capacity markets, both private paying and Medicaid residents are expected to choose a nursing home with better quality. In such

markets, a profit-maximizing provider will improve quality to attract both types of consumers.

Conceptual Model of Nursing Home Quality of Care

Since a majority of nursing homes are for-profit, it is reasonable to consider a for-profit nursing home for the current analysis. This helps in keeping the theoretical analysis simple and short. Therefore, a theoretical model for non-profit nursing homes is not developed in this analysis. The theoretical analysis in this study is based on the model developed by Scanlon (1980), Nyman (1985), Dusanski (1989), Grabowski (1998) and Norton (2000). These researchers developed their models for for-profit nursing homes. Therefore, all the theoretical predictions are based on the analysis for for-profit nursing homes. In my empirical analysis, I included a dummy variable to estimate the differences in quality between a non-profit and a for-profit nursing home. Under certain conditions, competition from nonprofit organizations leads to an improvement in quality among for-profit organizations (Hirth, 1999). This effect is controlled for by including a variable—the proportion of beds in the market owned by for-profit nursing homes. A nursing home is categorized as a monopolistically competitive entity that is required to provide at least a minimum quality (q_0) set forth by the HCFA and the respective state Medicaid authorities. In the analysis, a nursing home is assumed to provide the same quality of care to both Medicaid and private residents. McKay's (1989) findings support this assumption. It also assumes that a nursing home simultaneously chooses the level of quality to provide and the proportion of Medicaid residents to admit.

The private quantity demanded (X) is a function of private price (p) and quality (s). The total quality of nursing home care is equal to the sum of q_0 and s. The quality (s) is assumed

to be any effort above and beyond minimum quality (q_0) (an addition to earlier models) on the part of the nursing home to attract private residents. These efforts can consist of a cleaner facility, friendlier staff, extra services, more social programs, better public relations, being more responsive staff to residents' needs, bigger rooms, more staff per bed or use of modern technology. For empirical purposes, information on most of these aspects is not available for this study. Such activities may have direct or indirect effects on residents' outcomes. For most nursing home residents, the nursing home staff forms a large part of their social world, and any deficiencies in care or housekeeping or dietary services may have harmful effects on the well being of residents, especially the ones staying for longer periods of time (Institute of Medicine 1986). For example, neglect or cost-saving behavior may lead to unnecessary use of physical and chemical restraints which in turn leads to functional decline, falls, incontinence, bedsores and depression (Evans and Strumpf 1989; Libow and Starer 1989). Understaffed facilities may excessively use antipsychotic drugs, which may lead to declines in mobility and other negative health outcomes. Improper bed positioning can increase bedsores. Lack of privacy leads to lack of self-esteem and demoralization, which may lead to depression. High use of urethral catheterization increases the likelihood of a patient's functional decline and of contracting a urinary tract infection (Spector and Takada 1991), in turn leading to greater likelihood of hospitalization (Ouslander and Kane 1984; Ribiero and Smith 1985). Higher registered nursing staffing levels are found to be associated with positive health outcomes (Braun 1991). Therefore, quality (s) in this study will be measured in terms of lack of sampled individuals' negative health outcomes like bedsores, urinary tract infections, weight-loss, cellulitis, dehydration, malnutrition and injuries related to falls.

Nursing homes in different markets face different demand conditions and the specification of profit function and ensuing predictions for a nursing home facing excess demand differ from the one facing excess capacity. For this reason, these two situations will be analyzed separately.

It is assumed here that a profit maximizing nursing home that faces excess demand first admits higher paying private residents and then fills the remaining beds with Medicaid residents. Therefore "excess demand in nursing home markets" can safely be called as "Medicaid excess demand for nursing home services," as it is mostly the Medicaid eligible who find it difficult to gain admittance to nursing homes. In addition, it is safe to assume under the conditions of excess demand that Medicaid eligible residents seek placement in any nursing home irrespective of the level of its quality of care. The nursing home industry complains that Medicaid payments do not even cover the cost of care; therefore, it can be assumed that they do not consider Medicaid reimbursement to reward quality. Many researchers including Scanlon (1980), Nyman (1985; 1988a; 1988c), Dusansky (1989), Gertler (1989; 1992), Grabowski (1998) and Cohen and Spector (1996) have employed this paradigm.

In the excess demand case, a nursing home faces excess Medicaid demand and can fill any empty bed with a Medicaid resident. Attracting one extra private resident means that a nursing home must lose one Medicaid resident and raise quality. Thus, the cost of attracting an additional private resident not only includes the actual cost of increasing quality but also the loss of Medicaid revenue. Therefore, as the Medicaid rate increases, the opportunity cost of providing higher level of quality goes up. In such a case, marginal private revenues are less than the cost of additional quality to attract marginal private resident plus the forgone

cost of marginal Medicaid resident. As a result, a nursing home facing excess demand may resort to reducing quality as the Medicaid reimbursement rate increases, finding marginal Medicaid residents more profitable than marginal private residents.

Demand and Quality of Care

The private demand is assumed to be a function of private price (P) and quality (s) as shown below:

$$X = x(P, s)$$

Once a profit maximizing nursing home satisfies private demand, it fills the remaining capacity with Medicaid residents (M) given by the equation: $Y = x(P,s) + M$, where Y is the total number of beds. In excess capacity, Y is replaced with Z ($Y \geq Z$) representing the total number of filled beds and $Z = x(P,s) + M(s)$. As stated above, a nursing home facing excess demand does not consider Medicaid residents' preferences in its profit-maximizing problem. But in the case of excess capacity, the Medicaid quantity demanded is assumed to be a function of nursing home quality (s) alone. It is assumed that private demand decreases in private prices and increases in additional quality (s) at a decreasing rate. In excess capacity markets, Medicaid demand is assumed to increase at a decreasing rate with additional quality (s). It is also assumed that quality elasticity of private demand is higher than quality elasticity of Medicaid demand. Average cost has two components $c(q_0)$ and $c(s,Z)$. The first component ($c(q_0)$) is assumed to be fixed per resident for a given minimum quality level and this component increases with increases in minimum quality levels at an increasing rate. The second component increases with quality (s) and total number of residents (Z) at an increasing rate. R denotes the Medicaid reimbursement rate. A nursing home's profit

maximizing problem in two different markets can be written as:

[1] Case of Excess Demand $\pi = Px(P,s) + R(Y - x(P,\ s)) - (c(q_o) + c(Y,s))Y$

[2] Case of Excess Capacity $\pi = Px(P,s) + RM(s) - (c(q_o) + c(Z,s))Z$

The choice variables for this problem are the private price (P) and quality (s). It is assumed that a profit maximizing provider will not operate at a loss. The first-order conditions for the excess demand case (equation [1]) with respect to price and quality can be written as:

[3] $$\frac{\partial \pi}{\partial P} = x + Px_P - Rx_P = 0$$

[4] $$\frac{\partial \pi}{\partial s} = Px_s - Rx_s - c_s Y = 0$$

The first equation [3] indicates that in equilibrium, the marginal revenue from additional private residents equals the marginal revenue loss from the replaced Medicaid residents. The second equation [4] indicates that at equilibrium, the revenue gained from additional private residents as a result of improvements in quality equals the sum of the marginal cost of improving quality for all occupied beds and the losses in revenue from the displaced Medicaid residents. This means that any increase in the Medicaid payment deters quality improvement efforts in excess demand markets.

Considering the first-order condition with respect to price (equation [3]), the following equations can easily be derived.

[5] $$R = P + \frac{x}{x_P} = P\left(1 + \frac{1}{\eta_{xP}}\right)$$

[6] $$P - R = -\frac{1}{\eta_{xP}}$$

These equations indicate that in the case of excess demand as the price elasticity of private demand increases, the private price approaches the Medicaid price. If nursing homes

do not resort to much quality or geographic differentiation, then it is expected that the private price will approach the Medicaid rate with increases in market competition as in such cases the price elasticity of private demand is expected to increase.

To find the effects of changes in exogenous variables on the quality of care, it is important to carry out total differential of first-order conditions.

Total differential of equation [3]:

[7] $$x_P dp + x_s ds + dPx_P + P(x_{PP}dP + x_{Ps}ds) - dRx_P - R(x_{PP}dP + x_{Ps}ds)$$

Total differential of equation [4]:

[8] $$x_s dp + P(x_{sP}dP + x_{ss}ds) - dRx_s - R(x_{sP}dP + x_{ss}ds) - Yc_{ss}ds$$

The Hessian matrix for a profit maximizing nursing home in excess demand markets (equation [1]) is shown below:

[9] $$J = \begin{bmatrix} 2x_P + (P-R)x_{PP} & x_s + (P-R)x_{Ps} \\ x_s + (P-R)x_{sP} & (P-R)x_{ss} - Yc_{ss} \end{bmatrix}$$

The Hessian matrix for a profit maximizing nursing home in excess capacity markets (equation [2]) is shown below:

$$[9a]\ J = \begin{bmatrix} \begin{array}{l} (P - c_Z Z - (c(q_0)+c))x_{PP} \\ -(2c_Z + Zc_{ZZ})x_P^2 + 2x_P \end{array} & \begin{array}{r} x_s - (2c_Z + Zc_{ZZ})x_P(x_s + M_s) - Zx_P c_{Zs} \\ -x_P c_s + (P - c_Z Z - (c(q_0)+c))x_{Ps} \end{array} \\ \begin{array}{l} (P - c_Z Z - (c(q_0)+c))x_{sP} \\ -(2Z_s c_Z + ZZ_s c_{ZZ} \\ + Zc_{sZ} + c_s)x_P + x_s \end{array} & \begin{array}{r} (P - c_Z Z - (c(q_0)+c))x_{ss} - (Zc_Z + (c(q_0)+c))M_{ss} \\ -Zc_{ss} - Z_s c_s - ZZ_s c_{Zs} - (2Z_s c_Z + ZZ_s c_{ZZ} \\ + Zc_{sZ} + c_s)(x_s + M_s) + RM_{ss} \end{array} \end{bmatrix}$$

Effect of an Increase Medicaid Reimbursement on

Quality of Care

The effect of an increase in Medicaid reimbursement on the quality of nursing home care using Cramer's rule can be written as:

[10]
$$\frac{ds}{dR} = \frac{x_s\left(2x_P + (P-R)x_{PP}\right) - x_P\left(x_s + (P-R)x_{sP}\right)}{|J|}$$
$$= \frac{x_s\left(x_P + (P-R)x_{PP}\right) - x_P(P-R)x_{sP}}{|J|}$$
$$= \frac{(+)(-)-(-)(+)(-)}{(+)} <$$

The denominator is the determinant of the Hessian matrix of a profit-maximizing problem and must be positive. In the numerator, the argument in the first parenthesis $(2x_p + (P-R)x_{pp})$ is the second-order derivative of a profit maximizing function with respect to prices and is defined as the change in the rate of profit with respect to private price as the private price increases by one dollar. The argument $(x_s + (P-R)x_{sp})$ in the second parenthesis, in the numerator, represents a change in the rate of profit with respect to the additional quality as the private price increases by one dollar. The sign of this equation depends upon the signs of x_{pp} and x_{sp}. Their signs depend upon the assumptions of demand behavior. Assuming that x_{pp} and x_{sp} are negative or zero, then the numerator becomes negative. This means that the quality of nursing home care may fall with increases in the Medicaid reimbursement rate. A similar analysis for excess capacity cases indicates that additional quality improves with increases in Medicaid reimbursement rate. These predictions match the predictions of models developed by Nyman (1985), Dusansky (1988), Norton (2000) and Grabowski (1998).

Proportion of Medicaid Residents

In the excess demand case, the proportion of Medicaid residents increases with an increase in the Medicaid reimbursement rate. It can be shown by the following equation:

$$[11] \qquad \frac{d\left(\frac{Y-x}{x}\right)}{dR}=\frac{-x\left(x_P\frac{dP}{dR}+x_s\frac{ds}{dR}\right)-(Y-x)\left(x_P\frac{dP}{dR}+x_s\frac{ds}{dR}\right)}{x^2}$$

$$=\frac{-Y\left(x_P\frac{dP}{dR}+x_s\frac{ds}{dR}\right)}{x^2}$$

$$=\frac{(-)(+)((-)(+)+(+)(-))}{(+)}>0$$

The first argument $x_p(dP/dR)$, in the parentheses, represents the price effect of a dollar increase in the Medicaid reimbursement rate on the private residents' demand. It contains two terms: the first term is negative by the assumption that private demand decreases with increases in private prices. The second term is positive by Cramer's rule. The second argument $x_s(ds/dR)$, in the parenthesis, indicates the effect on private demand that a dollar increase in the Medicaid reimbursement rate causes by changing the quality of nursing home care. It also has two terms. The first term is positive by assumption that private demand increases with increases in the additional quality of care. The second term is negative as shown above.

In the excess capacity case, the effect of an increase in Medicaid reimbursement rate on the proportion of Medicaid residents in a nursing home is derived using Cramer's rule. Without making further assumptions, this effect remains undetermined. It can be shown by the equation in the next page:

[12]
$$\frac{d\left(\dfrac{M}{x}\right)}{dR}=\frac{x\dfrac{\partial M}{\partial s}\dfrac{\partial s}{\partial R}-M\left(\dfrac{\partial x}{\partial s}\dfrac{\partial s}{\partial R}+\dfrac{\partial x}{\partial P}\dfrac{\partial P}{\partial R}\right)}{x^2}$$
$$=\frac{(+)(+)(+)-(+)((+)(+)+(-)(+))}{(+)}$$
$$=\frac{(+)-((+)+(-))}{(+)}$$

The numerator has two parts. The first part represents the product of the nursing home's private residents' population and the change in the Medicaid residents' population due to a dollar increase in the Medicaid reimbursement rate. The second part represent the product of the nursing home's Medicaid population and the change in the private residents' population as a result of the changes in the nursing home's additional quality and private price due to a dollar increase in the Medicaid reimbursement rate. This equation cannot be signed *a priori*. The direction of change in the Medicaid proportion depends upon various factors: private prices, quality levels, amount of changes in private prices and nursing home quality levels in response to changes in Medicaid rates, elasticity of private demand with respect to prices and elasticities of Medicaid and private demand with respect to quality.

The denominator being a square term has to be positive. Therefore, the sign of the equation depends upon the sign of the numerator. The equation [12] can be rewritten as:

[13]
$$\frac{d\left(\dfrac{M}{x}\right)}{dR}=\frac{\dfrac{M}{x}\left[\dfrac{1}{s}\eta_{Ms}\dfrac{\partial s}{\partial R}-\left(\dfrac{1}{s}\eta_{xs}\dfrac{\partial s}{\partial R}+\dfrac{1}{P}\eta_{xP}\dfrac{\partial P}{\partial R}\right)\right]}{x^2}$$
$$=\frac{(+)[(+)(+)(+)-((+)(+)(+)+(+)(-)(+))]}{(+)}$$

Where; η_{xs} and η_{Ms} are the quality elasticities of private and Medicaid residents respectively. η_{xP} is the price elasticity of private demand. To sign the numerator, the following assumptions are made: a) The price elasticity of private demand is significantly smaller than

the private price, making the second term in the inner bracket insignificant; and b) The quality elasticity of private demand is higher than the quality elasticity of Medicaid demand.

In the numerator, the term M/x outside the parentheses is positive because it is the ratio of Medicaid and private residents. The term $(1/P)\eta_{xP}(\partial P/\partial R)$ represents the price effect of a dollar increase in the Medicaid reimbursement rate on the change in the proportion of private residents $(\partial x/x)$ and is insignificant by assumption (a). The first term $(1/s)\eta_{xs}(\partial s/\partial R)$ represents the quality effect of a dollar increase in the Medicaid reimbursement rate on the change in the proportion of private residents. The term $(1/s)\eta_{Ms}(\partial s/\partial R)$ represents the effect of a dollar increase in the Medicaid reimbursement rate on the change in the proportion of Medicaid residents $\partial M/M$. By assumption (b), the quality elasticity of private demand (η_{xs}) is greater than the quality elasticity of Medicaid demand (η_{Ms}), therefore, the value of term $(1/P)\eta_{xP}(\partial P/\partial n)+(1/s)\eta_{xs}(\partial s/\partial n)$ is going to be greater than the value of term $(1/s)\eta_{Ms}(\partial s/\partial R)$. Thus, the numerator is negative. This means that proportion of Medicaid residents is expected to decrease with the increases in the Medicaid reimbursement. This conclusion is counter-intuitive. However, this statement is based on the following assumptions (some of which may be very strong): 1) Elasticity of private demand with respect to quality is higher than the elasticity of Medicaid demand. 2) Because of insufficient demand, providers are not likely to increase the private price substantially. 3) Price elasticity of private demand is smaller than quality elasticity of private demand.

As the Medicaid reimbursement rate increases, a nursing home may increase quality as well as private price. With an increase in quality, a nursing home is likely to admit more Medicaid as well as private residents. It is expected to admit relatively more private

residents than Medicaid residents if it is assumed that the elasticity of private demand with respect to quality is higher compared to the elasticity of Medicaid demand and the price effect on private demand is negligible. To the extent the proportion of additional private residents to additional total residents admitted is higher than the existing proportion of private residents, it is expected that the proportion of private residents after reimbursement rate increases will be higher than what it was before any increase in the rate.

In brief, the model indicates that the additional quality of nursing home care decreases with an increase in the Medicaid reimbursement rate in the excess demand markets. But this quality increases with the increase in the reimbursement rate in the excess capacity markets. Increases in the reimbursement rate lead to an increase in the proportion of the Medicaid population in a nursing home located in the excess demand markets. In excess capacity markets, the proportion of the Medicaid residents decreases with any increase in the reimbursement rate.

Effect of Number of Firms (Competition)

On Quality

To keep the analysis simple, a Cournot model with identical nursing homes is applied. An increase in number of firms in a market with excess demand will affect only the private demand for a nursing home in that market. There will be more firms competing for the same pool of private residents. With increases in number of nursing homes, private demand is expected to be more elastic as the prospective consumers have more choices. Therefore, it is assumed that the private demand facing a nursing home shifts left with increases in competition. In addition, there will be a greater decrease in private demand for a given increase in private price as competition increases. Because the increases in the number of

firms will not affect a given nursing home's cost function, it is assumed that the marginal cost function of a nursing home remains unchanged irrespective of any changes in market competitiveness. It is also assumed that private demand does not become perfectly elastic with respect to either quality or price (Norton 2000). To conduct this analysis, the first-order equations (3 and 4) obtained above are differentiated with respect to number of firms (n) and the results are shown below.

[14]
$$\begin{aligned}\pi_{Pn} &= x_n + Px_{Pn} - Rx_{Pn} \\ &= x_n + (P - R)x_{Pn} \\ &= (-) + (+)(-) \quad < 0\end{aligned}$$

[15]
$$\begin{aligned}\pi_{sn} &= (P - R)x_{sn} - c_{qn}Y \\ &= (+)(+) - (0) > 0\end{aligned}$$

As stated above, since the private price is at least as high as the Medicaid price, $(P - R)$ will always be positive. The two equations above indicate that π_{pn} and π_{sn} are negative and positive respectively. Using Cramer's rule, the effect of increases in the number of firms or competition in the excess demand markets is written below:

[16]
$$\begin{aligned}\frac{ds}{dn} &= \frac{-\pi_{sn}\left(2x_P + (P-R)x_{PP}\right) + \pi_{\mathrm{Pn}}\left(x_s + (P-R)x_{sP}\right)}{|J|} \\ &= \frac{(-)[(-)+(+)(-)]+(-)[(+)+(+)(-)]}{(+)} \\ &= \text{Undetermined}\end{aligned}$$

The first part of the numerator is positive with the assumptions set forth earlier that x_{PP} is negative or zero. The argument in the second part of the numerator has a mixed sign. If we assume that $(P - R)x_{sP}$ is greater than or equal to x_s. This means that the loss of revenue from private residents for Medicaid residents as a result of increases in price as quality increases are at least equal to the increases in revenue from private residents as quality increases and the second term in the numerator becomes positive. In such situations, quality

will increase with increases in the number of firms or competition in the market with excess demand.

In cases of excess capacity, the change in quality for an increase in competition can be shown as below:

$$[17] \qquad \frac{ds}{dn} = \frac{-\pi_{sn}\left(2x_P + (P - c_Z Z - (c(q_0) + c))x_{PP}\right) - \left(2c_Z + Zc_{ZZ}\right)x_P^2\right) + \pi_{Pn}\pi_{sP}}{|J|}$$

$$= \frac{(-)((-) + (+)(-)) + (-)(+)(+) + (-)(-)}{(+)} > 0$$

The denominator is the determinant of a second order Hessian matrix and must be positive. The component (π_{sn}), outside of the parenthesis of the first term, represents the change in the rate of profit with respect to a change in the additional quality as the number of firms increase by one. This component is found to be positive using Cramer's rule. The term x_P is negative by assumptions set in the beginning of the analysis. The argument $P - c_Z Z - (c(q_0) + c)$ is positive from the first-order conditions of the profit-function. The argument outside parentheses x_{PP} is zero or negative by assumption. The third term $(2c_Z + Zc_{ZZ})x_P^2$ is positive and needs no explanation. The argument inside the parenthesis in the numerator must be negative as it is the second derivative of a profit maximizing function in prices. In the numerator, the first element (π_{Pn}) of the second term is negative. But the second element (π_{Ps}) representing the change in the rate of profit with respect to private price as the additional quality increases by a unit is difficult to sign. If it is assumed to be negative or insignificant then the whole numerator is positive and it is concluded that the quality of nursing homes increases with the increases in the number of firms or competition in the market facing excess capacity.

Proportion of Medicaid Residents

In the short run, a nursing home may not be able to respond appropriately to changes in the number of firms in the market. The changes in the Medicaid proportion of a nursing home in an excess demand market can be shown by the equation below:

[18]
$$\frac{d\left(\frac{Y-x}{x}\right)}{dn} = \frac{-x(x_n)-(Y-x)(x_n)}{x^2} = \frac{-Y(x_n)}{x^2} = \frac{(-)(+)(-)}{(+)} > 0$$

With the increases in nursing homes or competition, the private demand for a given nursing home falls by assumption. If it is assumed that a nursing home will not be able to respond in the short run then its Medicaid proportion will increase with the increases in number of firms or competition in the short run. Because private paying residents bring in more revenue, the nursing homes will try to increase quality as quickly as possible. Therefore, in the long run, the change in the proportion of the Medicaid population of a given nursing home in the excess demand market as the number of firms increases can be shown by the equation below:

[18a]
$$\frac{d\left(\frac{Y-x}{x}\right)}{dn} = \frac{-x\left(x_P\frac{dP}{dn}+x_s\frac{ds}{dn}\right)-(Y-x)\left(x_P\frac{dP}{dn}+x_s\frac{ds}{dn}\right)}{x^2} = \frac{-Y\left(x_P\frac{dP}{dn}+x_s\frac{ds}{dn}\right)}{x^2} = \frac{(-)(+)((-)(-)+(+)(+))}{(+)} < 0$$

The first argument $x_p(dp/dn)$, in the parentheses, represents the price effect that an increase in the number of firms in the market has on private residents' demand. It contains

two terms: the first term is negative by the assumption that private demand decreases with increases in private prices. The second term is negative by Cramer's rule. The second argument $x_s(ds/dn)$, in the parenthesis, indicates the effect on private demand caused by a change in the additional quality of nursing home care with the entry of an additional firm in the market. This argument also has two terms. The first term is positive by assumption and the second is positive too as shown earlier. Therefore, it can be concluded that in the long run the proportion of Medicaid population will decrease with increases in the number of firms in the market.

In the case of excess capacity, the direction of change in the proportion of the Medicaid population with increases in the number of firms in the market remains undetermined without making further assumptions. The equation is given below:

[19]
$$\frac{d\left(\frac{M}{x}\right)}{dn} = \frac{x\frac{\partial M}{\partial s}\frac{\partial s}{\partial n} - M\left(\frac{\partial x}{\partial s}\frac{\partial s}{\partial n} + \frac{\partial x}{\partial P}\frac{\partial P}{\partial n}\right)}{x^2}$$
$$= \frac{\frac{M}{x}\left[\frac{1}{s}\eta_{Ms}\frac{\partial s}{\partial n} - \left(\frac{1}{s}\eta_{xs}\frac{\partial s}{\partial n} + \frac{1}{P}\eta_{xP}\frac{\partial P}{\partial n}\right)\right]}{x^2}$$
$$= \frac{(+)[(+)(+)(+) - ((+)(+)(+) + (+)(-)(-))]}{(+)}$$

Where η_{xs} and η_{Ms} are the quality elasticities of private and Medicaid residents respectively and η_{xP} is the price elasticity of private demand. To sign the numerator, the assumptions made in examining the effect of the Medicaid reimbursement rate on the proportion of Medicaid residents are assumed in this case too. In the numerator, the term M/x is positive as it is the ratio of Medicaid and private residents. The term $(1/P)\eta_{xP}(\partial P/\partial n)$ represents the price effect that the entry of a new nursing home in the market has on the change in the proportion of private residents and is insignificant by assumption (a). The term

$(1/s)\eta_{xs}(\partial s/\partial n)$ represents the quality effect caused by the entry of a new nursing home in the market on the change in the proportion of private residents. The term $(1/s)\eta_{Ms}(\partial s/\partial n)$ represents the effect that a new nursing home's entry in the market has on the change in the proportion of Medicaid residents. By assumption (b), the quality elasticity of private demand (η_{xs}) is greater than the quality elasticity of Medicaid demand (η_{Ms}), therefore, the value of term $(1/P)\eta_{xP}(\partial P/\partial n)+(1/s)\eta_{xs}(\partial s/\partial n)$ is going to be greater than the value of term $(1/s)\eta_{Ms}(\partial s/\partial n)$. Thus, the numerator is negative. This means that proportion of Medicaid residents is expected to decrease with the increases in the number of firms in the market.

In brief, the model indicates that the additional quality of nursing home care increases with an increase in the number of firms irrespective of market demand conditions. Increases in the number of firms leads to a decrease in the proportion of the Medicaid population in a nursing home.

Effect of Increases in Minimum Quality Levels

On Quality

The response of a nursing home to changes in the minimum quality limits set forth by the government is expected to vary with that nursing home's existing quality level. The existing quality level is inversely associated with the proportion of Medicaid population in a nursing home (Kosberg et al., 1972; Gottesman, 1974; Fottler et al., 1981; Weissert et al., 1985, Grabowski, 1998). Therefore, the effect of changes in the minimum quality standards on the overall quality provided by a nursing home is expected to vary with the proportion of its Medicaid population. To examine this relation, the first-order equation of profit function with respect to quality is analyzed.

For a nursing home with 100 percent Medicaid population in a market facing excess demand, this equation [4] becomes:

$$\text{[20]} \qquad \frac{\partial \pi}{\partial s} = -c_s Y \leq 0$$

This means that a nursing home facing excess demand and having 100 percent Medicaid population will have no incentive to provide any additional quality above and beyond the minimum quality levels (q_0) set forth by the government. In such homes, any additional increase in the minimum quality will lead to higher levels of quality of care. On the other hand, nursing homes with at least one private patient will increase quality above the minimum levels to the extent that increases in private revenue as a result of increases in quality equals the sum of increases in marginal costs and the loss of marginal revenue from displaced Medicaid patients as shown below.

$$\text{[21]} \qquad \frac{\partial \pi}{\partial s} = Px_s - Rx_s - c_s Y = 0$$

For a nursing home facing excess capacity and having 100 percent Medicaid population, this equation becomes:

$$\text{[22]} \qquad \frac{\partial \pi}{\partial s} = RM_s - C_s M - \mathrm{C}_M M_s M - (c(q_0) + c(Z, s))M_s$$
$$= 0$$

This equation shows that a nursing home having 100 percent Medicaid residents facing excess capacity will also provide additional quality above and beyond government set minimum standards to the point where the marginal revenue from additional quality increases equals the marginal cost of quality increases. This is contrary to the situation of excess demand. In the excess capacity case, a nursing home with at least one private patient will have optimal quality levels shown by the first-order conditions. It can easily be concluded

that quality levels in a nursing home with at least one private patient are going to be higher than the levels provided by a nursing home with 100 percent Medicaid population. Also, it is anticipated that the quality of care, in general, will be higher in markets facing excess capacity than the markets facing excess demand. But the effect of any increase in the minimum quality standards will be more pronounced in the markets facing excess demand than in the markets with excess capacity.

To analyze the effects of increases in minimum quality levels set forth by the government, it is assumed that private demand increases with increases in minimum quality levels. Also, the change in private demand with respect to private price remains unaffected as the minimum quality increases. Similarly, there is less increase in private demand for a given increase in quality as the minimum quality increases. Differentiating first-order equations of the profit maximization function obtained above, the following results are obtained.

[23]
$$\begin{aligned}\pi_{Pq_0} &= x_{q_0} + Px_{Pq_0} - Rx_{Pq_0} \\ &= x_{q_0} + (P-R)x_{Pq_0} \\ &= (+) + (+)(0) > 0\end{aligned}$$

The second term is zero by assumption. The first term x_{q_0} is positive by assumption. Therefore, the rate of change in profits with respect to private price increases with any increase in minimum quality levels. The effect of increases in minimum quality levels on the rate of change in profits with respect to a given change in additional quality levels is written below.

[24]
$$\begin{aligned}\pi_{sq_0} &= (P-R)x_{sq_0} - c_{sq_0}Y \\ &= (+)(-) - (+) < 0\end{aligned}$$

The first and second terms are negative and it is concluded that the rate of change in the profits with respect to increases in additional quality levels increases with any increases in the minimum quality level.

The effect of minimum quality levels on additional quality provided by a nursing home in excess demand markets is shown by the equation below:

$$[25] \qquad \frac{ds}{dq_0} = \frac{-\pi_{sq_0}\left(2x_P + (P-R)x_{PP}\right) + \pi_{Pq_0}\left(x_s + (P-R)x_{sP}\right)}{|J|}$$
$$= \frac{(+)((-)+(+)(-)) + (+)((+)+(+)(-))}{(+)} < 0$$

The denominator is positive as usual and the first term in the numerator is negative. The argument of the second term in the numerator has a mixed sign. Again if we assume that $(P-R)x_{sp}$ is greater than or equal to x_s which means that the loss of revenue from private residents for Medicaid residents as a result of increases in price as quality increases are at least equal to the increases in revenue from private residents as quality increases, the second term in the numerator becomes negative. Under these assumptions, the additional quality decreases for a given increase in the minimum quality levels set by the government in the market with excess demand.

Change in quality levels provided by a nursing home facing excess capacity for a given change in the minimum quality level set by the government is given by the equation below:

$$[26] \qquad \frac{ds}{dq_0} = \frac{Z_s\left(2x_P + \left(P - c_Z Z - (c(q_0)+c)\right)x_{PP} - (2c_Z + Zc_{ZZ})x_P^2\right) - x_P\pi_{sP}}{|J|}$$
$$= \frac{(+)[(-)+(+)(-)] - (-)(+)}{(+)} < 0$$

The denominator is positive for the reasons stated earlier. The term Z_s is positive by assumption. The argument (x_P), in the parentheses of the first part, is negative by

assumption. The second argument is zero for a linear demand function ($x_{PP}=0$). The third argument $(2c_Z + Zc_{ZZ})x_P^2$ in the first part is trivial to sign and it is positive by assumption. Thus, the argument in the parenthesis in the numerator is negative. This argument should be negative as it is the second derivative of a profit maximizing function with respect to private price. The second term $x_P\pi_{sP}$ in the numerator is difficult to sign without making an assumption. The first part of this term is negative by assumptions set in the beginning. But the second element (π_{Ps}) representing the change in the rate of profit with respect to private price as the additional quality increases by a unit is difficult to sign *a priori*. If it is assumed to be negative or insignificant then the whole numerator is negative. Therefore, it is concluded that the additional quality above and beyond the minimum standards set forth by the government is expected to reduce, in markets facing excess capacity, with the increases in the minimum quality levels set forth by the government.

Proportion of Medicaid Residents

In the short run, the proportion of the Medicaid population is expected to decrease with the increases in minimum quality levels set by the government in markets with excess demand for nursing home services. The equation is shown below:

[27]

$$\frac{d\left(\frac{Y-x}{x}\right)}{dq_0} = \frac{-x(x_{q_0})-(Y-x)(x_{q_0})}{x^2} = \frac{-Y(x_{q_0})}{x^2} = \frac{(-)(+)(+)}{(+)} < 0$$

By assumption, private demand increases with an increase in the minimum quality levels set by the government. Therefore, the term in the numerator becomes negative. In the short

run when nursing homes are not able to make appropriate adjustments in response to this requirement, it is anticipated that the proportion of the Medicaid population in the nursing home will go down.

In the long run, the Medicaid population is expected to go up as the nursing homes located in excess demand markets make necessary adjustments to meet all the minimum quality requirements. In the long run the nursing home population mix can be shown by the equation below:

[28]

$$\frac{d\left(\frac{Y-x}{x}\right)}{dq_0} = \frac{x\left(x_p \frac{dP}{dq_0} + x_s \frac{ds}{dq_0}\right) - (Y-x)\left(x_p \frac{dP}{dq_0} + x_s \frac{ds}{dq_0}\right)}{x^2}$$

$$= \frac{Y\left(x_p \frac{dP}{dq_0} + x_s \frac{ds}{dq_0}\right)}{x^2}$$

$$= \frac{(-)(+)((-)(+)+(+)(-))}{(+)} > 0$$

The argument $x_P(dP/dq_0)$ represents the price effect of increases in minimum quality standards on the private demand for nursing home care. It has two terms: the first term is negative by assumption and the second term is found to be positive using Cramer's rule. The second argument $x_s(ds/dq_0)$ represents the quality effect of changes in minimum quality standards on the private demand for nursing home care and it also has two terms: the first term is positive by assumption and the second term is negative as shown earlier. Since the numerator becomes positive and the denominator is positive, it is concluded that the proportion of the Medicaid population, in markets facing excess demand, will increase with the increases in the minimum quality set forth by the government.

In the case of excess capacity markets, changes in the proportion of the Medicaid population in a nursing home with any increases in minimum quality requirements set by the government is shown in the next page:

$$[29] \qquad \frac{d\left(\frac{M}{x}\right)}{dq_0} = \frac{x\frac{\partial M}{\partial s}\frac{\partial s}{\partial q_0} - M\left(\frac{\partial x}{\partial s}\frac{\partial s}{\partial q_0} + \frac{\partial x}{\partial P}\frac{\partial P}{\partial q_0}\right)}{x^2}$$

$$= \frac{\frac{M}{x}\left[\frac{1}{s}\eta_{Ms}\frac{\partial s}{\partial q_0} - \left(\frac{1}{s}\eta_{xs}\frac{\partial s}{\partial q_0} + \frac{1}{P}\eta_{xP}\frac{\partial P}{\partial q_0}\right)\right]}{x^2}$$

$$= \frac{(+)[(+)(+)(-) - ((+)(+)(-) + (+)(-)(+))]}{(+)}$$

Where η_{xs} and η_{Ms} are the quality elasticities of private and Medicaid residents respectively and η_{xP} is the price elasticity of private demand. To sign the numerator, the assumptions made in examining the effect of the Medicaid reimbursement rate on the proportion of Medicaid residents are assumed in this case too. In the numerator, the term M/x is positive, as it is the ratio of Medicaid and private residents. The term $(1/P)\eta_{xP}(\partial P/\partial q_0)$ represents the price effect that an increase in minimum quality requirements by a unit has on private demand and is insignificant by assumption (a). The term $(1/s)\eta_{xs}(\partial s/\partial q_0)$ represents the quality effect of increases in minimum quality standards on private demand. The whole term $(1/s)\eta_{xs}(\partial s/\partial q_0)+(1/P)\eta_{xP}(\partial P/\partial q_0)$ in the inner parenthesis shows the proportional change in private residents in a given nursing home due to an increase in minimum quality requirements. The term $(1/s)\eta_{Ms}(\partial s/\partial q_0)$ represents the proportional change in Medicaid residents due to the effect of a unit increase in minimum quality on the level of addition quality. By assumption (b), the quality elasticity of private demand (η_{xs}) is greater than the quality elasticity of Medicaid demand (η_{Ms}), therefore, the absolute value of term

$(1/s)\eta_{xs}(\partial s/\partial q_0)+(1/P)\eta_{xP}(\partial P/\partial q_0)$ is going to be greater than the absolute value of term $(1/s)\eta_{Ms}(\partial s/\partial q_0)$. Thus, the numerator is positive. This means that proportion of Medicaid residents is expected to increase with the increases in the minimum quality standards. The results of the comparative statics of the model are shown in Table 2.1.

In summary, the results of this analysis indicate that under certain conditions the quality of nursing home care increases with competition or number of firms in the market irrespective of market demand conditions. In contrast, additional quality-improving efforts of nursing homes, if certain conditions are met, decrease with increases in minimum quality set forth by the government irrespective of the demand conditions except in the case of a nursing home, in excess demand markets, with 100 percent Medicaid population. The effect of changes in minimum quality levels on the overall quality of care provided by a nursing home depends upon the substitutability between the contents of minimum quality requirements and the additional quality efforts. In this analysis, it has been assumed that the efforts to meet minimum quality requirements and the efforts to improve quality above and beyond minimum quality requirements are not perfectly substitutable. To the extent they are not substitutable, it is concluded that increases in minimum quality levels will negatively affect the overall quality of care. Under the assumptions set in the theoretical analysis, the effect of any changes in the Medicaid reimbursement rate on the quality of nursing home care differs with the market demand conditions as found in previous studies. From the analysis, it seems that a nursing home's decisions about the level of quality to be provided and the proportion of Medicaid residents to be admitted are jointly determined.

Table 2.1: Results of Comparative Statics

Exogenous Variables	Additional Quality (s)	Condition	Percent Medicaid (M/x)	Condition
	Excess Demand			
Medicaid Rate (R)	–	Private demand decreases in private prices at either a decreasing or constant rate. Cross partials of demand in prices and quality are negative or change in the rate of profit with respect to quality as the private price increases is either negative or insignificant.	+	Private demand decreases with increases in private prices and increases with increases in additional quality.
Number of Firms (Competition) (n)	+	Private demand decreases in private prices at either a decreasing or constant rate. Change in the rate of profit with respect to quality as the private price increases is either negative or insignificant	In the short run increases but in the long run decreases to below original levels	Same as above
Minimum Quality Levels (q_0)	–*	Private demand decreases in private prices at either a decreasing or constant rate. Cross partials of demand in prices and quality are negative zero or change in the rate of profit with respect to quality as the private price increases is either negative or insignificant	In the short run decreases but in the long run increases	Same as above
	Excess Capacity			
Medicaid Rate (R)	+	none	–	The elasticity of private demand with respect to price is insignificant compared to the private price. The quality elasticity of private demand is higher than the elasticity of Medicaid demand
Number of Firms (Competition) (n)	+	Private demand decreases in private prices at either a decreasing or constant rate. Change in the rate of profit with respect to quality as the private price increases is either negative or insignificant	–	Same as above
Minimum Quality Levels (q_0)	–	Same as above.	+	Same as above

* In nursing homes with 100 percent Medicaid residents, the overall quality will increase.

HYPOTHESIS

I will be using the following basic empirical model to test the hypothesis listed below:

Quality(Health outcome) = f(individual, facility and market characteristics, payer-mix).

Payer-mix(percent Medicaid residents) = f(individual, facility, market and state characteristics).

It is assumed in this study that the changes in minimum quality standards do not completely substitute the changes in the additional quality (*s*) by nursing homes. This means that the effects of the OBRA 87 required increases in minimum quality standards on the overall quality of nursing home care will follow the direction in which the additional quality is affected. Similarly, the effects of Medicaid reimbursement, competition and the market level demand on the overall quality of a nursing home will follow the direction in which the additional quality (*s*) is affected by any changes in these factors. If the above assumption is true, then the conceptual framework discussed in the previous section leads to the hypotheses listed in the Table 2.2.

Table 2.2: Testable Hypotheses

H1:	The quality of care decreases with OBRA 87 required increases in minimum quality standards in all nursing homes.
H2:	The quality of care increases with competition irrespective of market demand.
H3:	An increase in the Medicaid reimbursement rate leads to an improvement in the quality of nursing home care in excess capacity markets. In excess demand, however, it causes a decrease in quality.
H4:	In excess demand markets, the proportion of Medicaid residents increases with increases in the Medicaid reimbursement rate. The Medicaid proportion decreases with an increase in the Medicaid reimbursement rate in excess capacity markets or with increases in market competition in all markets. The Medicaid proportion increases with OBRA 87 required increases in minimum quality standards.

CHAPTER THREE

DATA AND METHODS

This study examines the effects of OBRA 87 required increases in minimum quality requirements, Medicaid reimbursement rate, market concentration and level of demand on quality of and access to nursing home care for the Medicaid population, after controlling for endogenous payer-mix and past negative health outcome occurrence history. The theory outlined earlier suggests that the Medicaid reimbursement rate, government policy for minimum quality, market concentration and level of demand affect the level of quality provided by nursing homes and the proportion of Medicaid residents admitted to nursing homes.

Endogeneity is said to exist, if there exist at least one omitted variable that is correlated with both a right hand side variable and the dependent variable. If this problem is not corrected then it will lead to a biased estimation of the relation between the said right hand side variable and the dependent variable. Quality of care affects private and public payer demand for individual nursing home services and the mix of these two payer types determines individual nursing home's quality levels. In addition, nursing homes located in markets with excess demand or high concentrations will exert some control over the payer-mix of residents admitted. This suggests that the decisions about quality levels and patient mix (Medicaid versus private) are made simultaneously. In addition, there are individuals in the sample who did not experience the negative health outcomes of interest while staying in

the nursing home either during the whole observation period or before their exit from the nursing home within the observation period (i.e., they were transferred, discharged, or died). Because information on health outcomes for individuals who exited before the end of study period is not available, this creates a right censoring problem. From the data, it is hard to determine whether these individuals were discharged to the community because they recovered fully or they went to another long-term care facility or hospital as a result of their worsening health or due to bad care in the nursing home. If people who exited before the end of study period are systematically related to health outcomes of interest or if there exist some unobserved factors that affect an individual's exit as well as their health outcomes, the analysis will produce biased results.

In addition, there may be some unobserved factors that affect nursing home residents' health outcome before and after admission to the nursing home, and likelihood of dying. Also, these unobserved factors affect residents' likelihood of being in a nursing home with a particular payer mix of residents. A series of tests conducted to examine the endogeneity of the Medicaid reimbursement rate, case mix at the facility-level, and exit variables failed to validate that these variables are endogenous in the models predicting current negative health outcomes, death outcome, and the percent Medicaid residents in the facility. Therefore, the variables indicating Medicaid reimbursement rate, case mix at the facility-level and exit are treated as exogenous explanatory variables in the system of equations. If the problems of endogeneity and censoring are not corrected, they will lead to biased and inconsistent estimates. Therefore, this study uses a system of simultaneous equations to get robust estimates of the effects of variables of interest to the nursing home's quality of care and access to such care for the Medicaid population. This section of the dissertation discusses the

data, variables, and estimation methods along with specification tests and summary statistics for key variables of interest. This analysis assumes that quality can be measured in terms of an individual resident's health outcomes as a function of nursing home, market and individual characteristics. Negative outcomes like bedsores, injuries, weight loss, infections, malnutrition, and urinary tract infections are assumed to be proxies for quality of care.

The following section provides a brief description of the data to be used in the study. In addition, it discusses the basic model that this study uses for empirical estimation followed by a detailed discussion of the empirical method, a discrete factor approach, to be used in the study. Also, it discusses the independent and dependent variables to be incorporated in the estimation to test the proposed hypotheses.

DATA

With the exception of the studies by Cohen and Spector (1996) and Chou (1998), past studies on the quality of nursing home care used either cross-sectional data or data from a limited number of states. This study will observe health outcomes of individuals in the sample of National Long-term Care Surveys (NLTCS) during their nursing home stay any time during the period starting April of 1984 and ending in June of 1995. The data set used for this study consists of one observation per individual and there can be more than one individual per nursing home. Information about an individual's health status prior to and during the sampled nursing home admission, along with other information on individual, facility, market and state characteristics is used. Various data sources are used to collect this information.

National Long-term Care Survey

NLTCS surveys elderly people at high risk of nursing home use and can be linked to other data sets like Medicare claims data, OSCAR, ARF, National Mortality data and data consisting of other market- and state-level information. Individuals in the NLTCS sample who were admitted to a nursing home any time between April 1984 and June 1995 are included in this study. An individual's latest admission to the nursing home during this period is chosen for the analysis. If the latest consecutive admissions of an individual were in the same facility, then the earliest of these admissions was chosen for the analysis. The sampling process ensures that none of the sampled individuals appear twice in the study.

Other Data Sets

Medicare part A and B records from 1984 to 1995 are examined to observe individuals' health status within the three months prior to admission to the nursing home and the negative outcomes listed above that occurred during the study period. Sampled individuals are observed during their stay in the nursing home for up to six months following admission. Medicare part A and B claims data provide information on an individual's stay in nursing homes and primary and secondary diagnoses from the visits to the doctor and hospital. Also, these data provide other individual-specific information such as age at admission, gender and ethnicity.

Individual-level information is merged with Medicaid and Medicare Certification survey (OSCAR) data using provider number and year of admission as matching key. OSCAR data provide information on payer mix, case mix, ownership type and market concentration for those nursing homes where the sampled respondents were residing during the respective time

periods. Multiple versions of the State Data Book on Long-term Care Programs and Market Characteristics (Harrington et al., 1996; 1998) and other data from Harrington and Swan provide information on state-level Medicaid reimbursement rates. County-level demographic, socioeconomic and health status information is obtained from the Bureau of Health Professions' Area Resource File. The National Death (ND) data set provides death outcome information. All these data sets can be linked by either individual-, county- or state-level unique identifiers.

County-level information is collected after merging data from all the counties that were split over time to the original counties. For example, the counties in Virginia like Alexandria, Chesapeake, Hampton, Newport News city, and Virginia Beach city are merged to Arlington, Norfolk/Portsmouth city, Hampton/Newport News city, and Norfolk/Portsmouth city respectively. Similarly, LaPaz in Arizona, Cibola in New Mexico, and Yellowstone Park (Part) counties are merged to Yuma, Valencia, and Park counties respectively. Most of the information is available for 1985, 1990 and 1995. For other years, information is imputed by fitting a straight line between the two points, as it approximated better than the exponential method. Observations from Alaska state are not included in the analysis because the data in the Area Resource File (ARF) on Alaska are not broken at the county level. Originally, there were 3,082 counties in the ARF and excluding Alaska results in 3,081 counties in the data. After merging split counties back to the original counties, the data contain 3,074 counties in total.

Facility-level information is collected from the OSCAR data. The facility-level and county-level information available for the nursing homes for the year prior to 1987 is scant. Because there were no significant changes during the period 1984 to 1988, the information

for years in the period 1984 to 1987 was imputed using information for the 1987 and 1988 calendar years and any available information from the 1984 to 1986 period. In addition, information on resident characteristics was available for the period 1984 to 1988. The facility information such as total beds was computed for these years using 1989 and 1990 data. It is assumed that it is highly unlikely for such information at the facility-level to have changed. To compute county-level and facility-level information, data for nursing homes owned by the same organization in a given county are aggregated and assumed a single entity. The intuition is that nursing homes owned by the same organization in a given market are more likely to have common administration. They are less likely to compete against each other and are more likely to behave like a single entity. In addition, the estimates were obtained for both the situations— treating each facility as a separate entity irrespective of the fact that they belonged to same owners, and treating all facilities belonging to same owners in a given market as single entity. Treating all the facilities owned by same owners as a single entity in a given market resulted in higher log-likelihood value indicating that treating all facilities in a given market owned by the same owners as single entity results in better estimation. In addition, duplicate records by provider IDs and facility location in a given county were deleted to have a unique record for a given facility in a county. After computing the information, facility-level information is merged to duplicate records as a result of change in ownership that were deleted earlier.

METHODS

The theory outlined earlier suggests that the Medicaid reimbursement rate, OBRA 87 required minimum quality, market concentration and level of demand affect the level of quality and the payer mix in nursing homes. Measuring these effects poses problems due to the presence of common unobserved factors that affect the proportion of Medicaid residents in the nursing home, a right-hand-side variable in the quality model. These unobserved factors also affect any of the negative outcomes encountered by the individual before current admission, another right-hand-side variable in both quality as well as proportion Medicaid resident equations. This study uses simultaneous equation methods to derive consistent estimates of the Medicaid reimbursement rate, competition and OBRA 87 effects on quality and access to nursing home care for the Medicaid population.

For empirical purposes, information on additional quality efforts such as room sizes, staff behavior etc. is not available for this study. But it is well known that such efforts have direct or indirect effects on residents' outcomes. For most nursing home residents, the nursing home staff forms a large part of their social world and any deficiencies in care or housekeeping or dietary services will have harmful effects on their well being, especially the ones staying for longer periods of time (Institute of Medicine, 1986). For example, neglect or cost-saving behavior may lead to unnecessary use of physical and chemical restraints which in turn leads to functional decline, falls, incontinence, bedsores and depression (Evans and Strumpf, 1989; Libow and Starer, 1989). Similarly, high use of urethral catheterization increases the likelihood of a resident's functional decline and contracting urinary tract infection (Spector and Takada, 1991). These effects lead to greater likelihood of

hospitalization too (Ouslander and Kane, 1984; Ribiero and Smith, 1985). Therefore, quality (*s*) in this study will be measured as sampled individuals' negative health outcomes.

This analysis assumes quality can be measured in terms of an individual client's health outcomes as a function of nursing home, market, individual characteristics and past negative health outcomes encountered by the individual. Negative outcomes including bedsores, urinary-tract infections, injuries, weight loss, dehydration, malnutrition, nosocomial infections and death will be used as proxies for quality of care. The Medicaid population's access is measured in terms of the percent Medicaid residents in the nursing home. In the quality model, the unit of analysis is the individual nursing home resident. In the percent Medicaid population model, the unit of analysis is the nursing home in which that individual stayed.

This section describes the methods and specification tests that this study will use in estimating the effects of factors mentioned above on the quality and access to nursing home care for the Medicaid population. Using the theoretical model discussed earlier, an empirical model is developed to estimate the likelihood of negative health outcomes. This section concludes with a review of how this empirical model is used to answer the questions raised earlier.

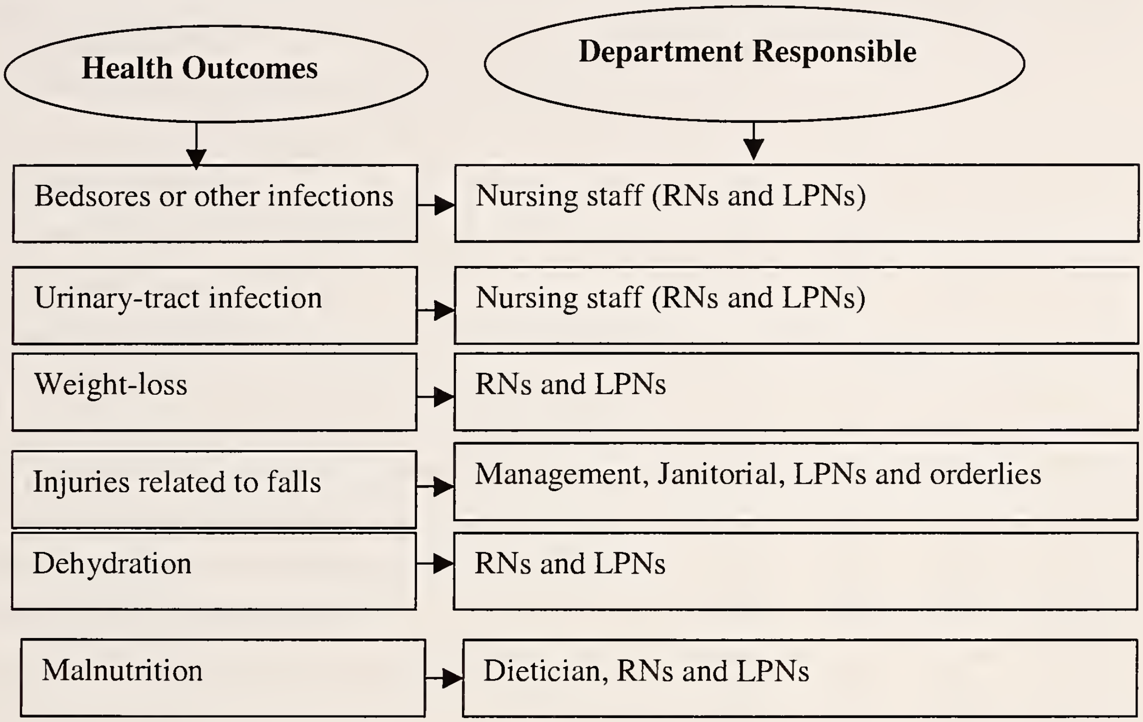
Basic Model

The estimation strategy partially accounts for censoring problems by using the following strategy. First, it is assumed that unobserved factors that affect the likelihood of an individual dying within the observation period also affect the likelihood of that individual encountering any of the negative health outcomes. It is also assumed that the common

unobserved factors that affect an individual's likelihood of encountering negative health outcomes in the past also influence that individual's likelihood of encountering similar negative health outcomes while in the nursing home, death or early exit. The variable "Early exit" is expected to be associated with an individual's probability of experiencing a negative health outcome for the following possible reasons. First, the duration of exposure to the risk of encountering negative health outcomes was shorter for such an individual compared to the one who remained till the end of the observation period. Second, there may be some individual specific unobserved factors that are correlated with that individual's likelihood of an early exit and the probability of encountering negative health outcomes as well. Inclusion of this variable in the outcome equations did not change the results indicating that people who exited during the study period are not different from the rest of the sample. Similarly, I failed to reject the null hypothesis indicating that this variable is exogenous in the outcome equations. This study does not include a separate equation for early exit since it is difficult to confirm the cause of exit. A person being discharged to his/her home is likely to have a different health status than a person being discharged to a hospital or other care settings.

Nursing home care comprises services provided by different departments like nursing, food, orderly and janitorial departments. The quality of services provided by each or a combination of the different departments will prevent certain kind of negative health outcomes. For example, good quality of care provided by the nursing staff (RNs and LPNs) can prevent bedsores. On the contrary, a well designed building with timely cleaning of floors and a good care by LPNs and orderlies can prevent nursing home residents from falling. Therefore, an analysis of a given negative health outcome in itself will not provide a good insight into the overall quality of the nursing home care. The following table provides

a possible link between each of the negative health outcomes to be examined in this study and the nursing home departments that can prevent these outcomes.



To assess overall nursing home quality of care, this analysis considers the occurrence of such health outcomes within six months of admission as the event of interest. A negative outcome is modeled as function of: (1) a continuous variable indicating the percent of Medicaid residents in the nursing home (*PM*); (2) a dummy variable indicating whether an individual had encountered any of the negative health outcomes in the past three months (E); (3) observable individual's characteristics including baseline health status (*X*); (4) an array of nursing home characteristics (*X*); and (5) an array of market and state characteristics (*X*) (see Table 3.1 for a complete description of these variables). If there are no other problems, a logit model can be used to estimate the effects of covariates on a sampled nursing home resident's negative health outcome.

Table 3.1: Variables included in the Model of Quality of Nursing Home Care

Variables	Equations (CNO)	(D)	(PM)	(PNO)
Dependent Variables				
Negative outcomes during nursing home stay (0,1)	1			
Death During nursing home stay (0,1)		1		
Endogenous Variables				
Percent Medicaid residents in the facility	λ^T	λ^M	1	
Past negative outcomes (0,1)	α^T	α^M	α^{PM}	1
Explanatory Variables				
Policy Variables				
OBRA 87 (=1, if admitted after Oct 1, 1990, else=0)	β^T	β^M	β^{PM}	β^E
High demand (=1, if occupancy rate>=0.93, else=0)	β^T	β^M	β^{PM}	β^E
Low demand (=1, if occupancy rate<=0.83, else=0)	β^T	β^M	β^{PM}	β^E
High competition (1, if Herfindhal index=0.1, else=0)	β^T	β^M	β^{PM}	β^E
High competition×high demand	β^T	β^M	β^{PM}	β^E
Medicaid reimbursement rate ($rate−$65.5)	β^T	β^M	β^{PM}	β^E
Rate×high demand	β^T	β^M	β^{PM}	β^E
Rate×low demand	β^T	β^M	β^{PM}	β^E
Market (County) Characteristics				
Nonworking women ≥16 per thousand aged ≥ 75	β^T	β^M	β^{PM}	β^E
Percent females in 75 years or over population	β^T	β^M	β^{PM}	β^E
Medicaid population per 10 elderly population	β^T	β^M	β^{PM}	β^E
Urban (=1 if urban, else=0)	β^T	β^M	β^{PM}	β^E
Average number of Medicare inpatient days	β^T	β^M	β^{PM}	β^E
Percent beds owned by for-profit nursing homes	β^T	β^M	β^{PM}	β^E
Number of services included in the Medicaid rate	β^T	β^M	β^{PM}	β^E
Facility Characteristics				
Non-profit nursing home (0,1)	β^T	β^M	β^{PM}	β^E
Mobility index	β^T	β^M	β^{PM}	β^E
Specialized care index×10	β^T	β^M	β^{PM}	β^E
Other care index/10	β^T	β^M	β^{PM}	β^E
Individual Characteristics				
Male (0,1)	β^T	β^M	β^{PM}	β^E
Black (0,1)	β^T	β^M	β^{PM}	β^E

(Table continued on next page)

Table 3.1: Variables included in the Model of Quality of Nursing Home Care

Variables	Equations (CNO)	(D)	(PM)	(PNO)
Age (age-70)	β^T	β^M	β^{PM}	β^E
Past Dementia and Alzheimer's disease problem (0,1)	β^T	β^M	β^{PM}	β^E
Past any Heart disease (0,1)	β^T	β^M	β^{PM}	β^E
Past Cancer (0,1)	β^T	β^M	β^{PM}	β^E
Past COPD or respiratory system disease (0,1)	β^T	β^M	β^{PM}	β^E
Past circulatory disease (0,1)	β^T	β^M	β^{PM}	β^E
Instruments (Identification restrictions)				
Average number of Medicaid inpatient days			β^{PM}	β^E
Past bowel and bladder incontinent (0,1)	β^T			β^E
Past Psychological problems (0,1)		β^M	β^{PM}	
Past Hypertension problem (0,1)			β^{PM}	
Past Diabetes problem (0,1)	β^T			β^E
Past Musculosekeletal or Osteoporosis disease (0,1)	β^T		β^{PM}	β^E
Past Parkinson disease (0,1)	β^T		β^{PM}	β^E
Past other infections (0,1)				β^E
Other Parameters				
Individual-level heterogeneity term	μ^T	μ^M	μ^{PM}	μ^E
County-level heterogeneity term	ε^T	ε^M	ε^{PM}	ε^E
Middle point(s) of support for individual-level heterogeneity	ψ_μ			
Weights for individual-level heterogeneity	θ_μ			
Middle point(s) of support for county-level heterogeneity	ψ_ε			
Weights for county-level heterogeneity	θ_ε			

Note: equations in this table are specified as follows:

PNO: Logit equation predicting probability of an individual having encountered any of the negative health outcomes within three months prior to nursing home admission.

CNO: Logit equation predicting probability of an individual having encountered any of negative health outcomes during his/her nursing home stay within study period.

D: Logit equation predicting probability of an individual dying during his/her nursing home stay within study period.

PM: Linear equation predicting the proportion of Medicaid residents in the nursing home in which an individual in this study got admitted.

Negative Health Outcomes include bedsores, urinary-tract infection, dehydration, malnutrition, infections, injuries and weight loss.

For individual i, the model can be expressed by the following equation:

$$[30] \qquad \ln\left(\frac{\Pr(T_i = 1 \mid T_i = 0)}{\Pr(T_i = 0 \mid T_i = 0)}\right) = PM_i\lambda^T + E_i\alpha^T + X_i\beta_l^T$$

Where $\Pr(T_i = 1)$ is the probability of individual i encountering negative health outcome (T).

This strategy may lead to biased estimates because the payer mix and past negative health outcome covariates in the quality model may be endogenous. A nursing home simultaneously chooses the percent of Medicaid residents to be admitted to the facility and the level of quality of care to be provided. These decisions may be affected by common factors that are not observed by researchers. Similarly, common unobserved factors are likely to affect an individual's likelihood of encountering a negative health before and after admission to a nursing home. The same factors will affect that individual's chances of gaining admission to a nursing home with a given payer mix. This problem is further complicated by the presence of censoring problem caused as a result of some individuals either dying or being discharged during the analysis period. A single equation model such as the one stated above cannot account for these unobserved factors. Therefore it is likely to yield biased estimates.

The empirical model used in this analysis solves these problems with the following strategy. This model assumes two possible levels of endogeneity. First, common unobserved time-invariant characteristics of an individual affect that individual's likelihood of encountering a negative health outcome, death, early discharge (thus negative health outcome or death) and the choice of a nursing home with a given pay mix. For example, an elderly individual with AIDS will be less likely to encounter negative health outcomes like bedsores or injuries but more likely to encounter untimely death or being in a nursing home with a higher proportion of Medicaid population. Similarly, an otherwise healthy individual

who had paralysis recently is less likely to encounter these negative health outcomes in the past or death in the nursing home but that individual is more likely to encounter negative health outcomes in the nursing home. Such an individual is more likely to be admitted to skilled nursing facilities, which are likely to have low percent of Medicaid population. Second, common unobserved nursing home market characteristics may affect an individual having encountered negative health outcomes before and after admission, death, and admittance to a given nursing home. For example, counties with relaxed state Medicaid eligibility criteria and with relatively high expenditures are likely to provide better access to nursing home care for the Medicaid population, with individuals receiving higher quality of nursing home care and greater likelihood of being diagnosed with past negative health outcomes due to stringent government enforcement of rules and regulations. This strategy will also account for error correlation arising due to multiple individuals in a given county. According to Angeles et al. (1996), the technique used to control for endogeneity of right-hand-side variables also accounts for the error correlation resulting from clustering problems.

Modified Basic Model to Account for Potential Endogeneity

To address the possible endogeneity and error correlation, a system of simultaneous equations that explicitly model the endogenous decision and the error correlation structure is implemented in the empirical analysis. The system includes a main equation for any of the negative health outcomes under considerations and three other equations. The other three equations in the system consist of one equation for the percent of the Medicaid population in a given nursing home to account for possible endogeneity, one for any of the negative health outcomes in the past three months prior to current admission and one for death within the

observed time period. Also, this system includes terms that account for time-invariant unobserved individual-level and market-level characteristics. These terms explicitly model the between-equation error correlation resulting from the endogeneity problem and error correlation across four equations—three specifying an individual's probabilities of having a given negative health outcome within three months before admission, after admission, or dying within study period. The fourth equation estimates the percent Medicaid residents in the nursing home where sampled individual is admitted.

To account for the possible relationship between a person's likelihood of death within the observed time and the occurrence of any of the negative health outcome due to unobserved factors, an equation is added to explicitly model this error correlation. A binary logit equation modeling the occurrence of death, which includes exogenous explanatory variables that reflect individual, nursing home, market and state characteristics, as well as the potentially endogenous past negative health outcomes variable is added. To achieve identification, both equations include individual-level past negative health outcome variables that are excluded from one but not from the other. Variables indicating that an individual has been diagnosed for bowel or bladder incontinence, diabetes, musculoskeletal disorders, osteoporosis, or Parkinsonism are excluded from the death equation but included in the negative health outcomes encountered in the nursing home. An individual with bowel or bladder incontinence is expected to have wet skin more often than the individual not having bowel and bladder problem. Wet skin can lead to the development of bedsores and other kinds of infections. Bowel or bladder incontinence does not cause death. Diabetes is not likely to cause death but a diabetic can more easily develop bedsores. If a person's sugar gets too low, the person can become dizzy and fall. Musculoskeletal disorder or osteoporosis

can cause a person to fall and possibly cause injury but either of the two diseases will not cause death. A person with Parkinson's disease is more likely wear and tear of their skin while lying on the beds as a result of their shaking problem. This increases their risk of developing bedsores. They are more likely to fall and sustain injury more easily. Parkinson's disease does not cause death. Past psychological problems are not expected to affect any of the current negative health outcomes but these problems may reduce the probability of death outcome due to extra care provided to such individuals.

To account for the potential endogeneity of percent Medicaid population in the current negative health outcomes and death equations, an auxiliary equation explicitly modeling the process of an individual's selection into a nursing home with a given percent of Medicaid residents is included in the system. A continuous measure of percent Medicaid residents in the nursing home is used in the model. To achieve identification, the percent Medicaid equation includes market-level and individual-level variables that are excluded from either death or any current negative health outcome equations. The variables indicating average number of Medicaid inpatient days, past psychological problems, and past hypertension are included in the percent Medicaid equation but are excluded from the current negative health outcomes equation. Increase in average number of Medicaid inpatient days can be seen as an indicator of higher State Medicaid expenditures. This may force State to tighten Medicaid eligibility requirements, which reduce an individual's likelihood of entering a nursing home with higher percent Medicaid residents. But such an action on the government part is not expected to affect an individual's likelihood of encountering either negative health or death outcomes in the nursing home. Individuals entering a nursing home with past psychological problems are expected to be those who do not need active medical treatment and are not a

risk to the health and safety of anybody. Because psychological problems do not require as much skilled nursing care, a person with such problems is more likely to enter a nursing home with higher percent Medicaid population. Also, psychological problems do not affect the likelihood of a person encountering negative health outcomes because these outcomes are essentially medical conditions. On the contrary, a person with such problems is expected to receive more attention from nursing home staff. This extra care increases the likelihood of early diagnosis and treatment of potentially life threatening conditions. Average number of Medicaid inpatient days, past hypertension problem, past osteoporosis or musculoskeletal problems, and past Parkinson's disease are excluded from death equation. Osteoporosis, musculoskeletal or Parkinson's disease does not require skilled nursing care. Also, any of these diseases does not affect an individual's risk to dying. Therefore, an individual having osteoporosis, musculoskeletal or Parkinson's disease is more likely to enter a nursing home with higher percent Medicaid residents. In summary, these variables are hypothesized to affect an individual's likelihood of being admitted to a nursing home with a given percent Medicaid residents but not his/her likelihood of either dying or encountering the negative health outcomes in the nursing home.

Three instrumental variables — average number of Medicaid inpatient days per 10 beneficiaries in the county, past psychological problems, and past hypertension problems □ are included in the percent Medicaid equation but are excluded from the current any of the negative health outcomes. Six instrumental variables — average number of Medicaid inpatient days per 10 beneficiaries in the county, past bowel and bladder problems, past hypertension problem, past diabetes, past musculoskeletal or osteoporosis disease or past Parkinsonism are included in the percent Medicaid population but are excluded from the

death equation. Overidentifying restrictions are tested for their validity using appropriate specification tests.

To account for the probable endogeneity of past negative health outcomes in the current negative outcomes, death and percent Medicaid equations, a binary logit equation is added to account for an individual's likelihood of encountering these health outcomes before being admitted to the nursing home. This equation includes exogenous individual-, facility-, market-, and state-level characteristic. This equation includes market-level and individual-level variables that are excluded from at least one of the current negative health outcomes, death and the percent Medicaid equations in order to achieve identification. Some of these instrumental variables are hypothesized to affect past negative health outcomes but not any of the negative health outcomes encountered in the nursing home. These variables are average number of Medicaid inpatient days per 10 beneficiaries and past occurrence of other infections. Average number of Medicaid inpatient days in a county indicates the health status of population in that county. An increase in the average number of days may be a sign of worse health status and it may be related to negative health outcomes of elderly population in the community. Elderly nursing home residents are not expected to be affected by this due to relatively higher level of care provided in the facility. Past infections can increase the risk of an individual encountering past negative health outcomes like malnutrition and weightloss. But past infections are not expected to affect an individual's likelihood of encountering negative health outcomes in the nursing home. Average number of Medicaid inpatient days per 10 beneficiaries, past bowel and bladder incontinence, diabetes, musculoskeletal disorder, osteoporosis, Parkinsonism and other infection problems are hypothesized to affect the likelihood of an individual encountering any of the negative health outcomes before

admission to a nursing home but not that individual's likelihood of dying in the nursing home. On the same account, other past infections is not expected to affect that individual's likelihood of being admitted to a nursing home with a given percent of Medicaid residents.

The following triangular system of simultaneous equations is estimated:

$$\ln\left(\frac{\Pr(T_{ij}=1)}{\Pr(T_{ij}=0)}\right)=PM_{ij}\lambda^{T}+E_{ij}\beta^{T}+X_{ij}\beta_{l}^{T}+\rho_{1}\mu_{ij}^{T}+\rho_{1\mathrm{E}}\varepsilon_{j}^{T} \tag{31}$$

$$\ln\left(\frac{\Pr(M_{ij}=1)}{\Pr(M_{ij}=0)}\right)=PM_{ij}\alpha^{M}+E_{ij}\beta^{M}+X_{ij}\beta_{l}^{M}+\rho_{2}\mu_{ij}^{M}+\rho_{2\mathrm{M}}\varepsilon_{j}^{M} \tag{32}$$

$$PM_{ij}=X_{ij}\beta_{l}^{PM}+E_{ij}\beta^{PM}+\rho_{3}\mu_{ij}^{PM}+\rho_{3\mathrm{PM}}\varepsilon_{j}^{PM}+\pi_{ij} \tag{33}$$

$$\ln\left(\frac{\Pr(E_{ij}=1)}{\Pr(E_{ij}=0)}\right)=X_{ij}\beta_{l}^{E}+\rho_{4}\mu_{ij}^{E}+\rho_{4\mathrm{E}}\varepsilon_{j}^{E} \tag{34}$$

Where *i* denotes the individual resident staying in a nursing home located in market (*j*). The first two equations model the log odds of an individual *i* having a negative health outcome (*T*) or dying (*M*) during the observation period. These outcomes are modeled as functions of *Percent Medicaid (PM)* residents, an endogenous variable, in the facility in which individual is living, a dummy variable (*E*) indicating an individual having encountered such negative health outcomes within three months prior to admission and other time invariant individual, facility, market and state characteristics (X_{ij}). Similarly, in the third equation, X_{ij} is a matrix of facility, market and state characteristics, a set of exogenous variables, and an endogenous dummy variable (*E*) for past negative health outcomes. The matrices (X_{ij}) are not identical across equations; each equation includes exogenous variables that are excluded from the other equations. The terms α, β, and β_l denote matrices of unknown coefficients that are estimated in the current analysis. The super-subscripts *E*, *T*, *M* and *PM* on these parameters identify respective equations of these parameters. Each equation and outcomes have their unique set of coefficients. The terms μ's and ε's represent components of the error terms

contributed by individual-level or market-level unobserved fixed characteristics. Terms denoted by ρ's represent correlation coefficients for the unobserved characteristics in each equation. Details on the endogenous and exogenous variables along with the instrumental variables to identify the model are given in Table 3.1.

Estimation Methods

Correlation among error terms across equations due to common unobserved characteristics leads to biased results using single equation techniques. Methods to account for this correlation involve two-stage instrument variable techniques. This method produces unbiased estimates in two-equation models, but it tends to generate large errors that create problems in hypothesis testing (Mroz and Guilkey, 1996). Another method called full-information maximum likelihood estimation requires analysts to make assumptions about the distribution of the error terms in the equations. But the discrete factor method imposes fewer assumptions on the distribution of the correlated error terms (Mroz and Guilkey, 1995; Mroz, 1997). This technique guards against biases caused by imposing incorrect distribution assumptions on the error terms. Therefore, this analysis will use discrete factor methods to solve the endogeneity problem. This technique approximates the distribution of unobserved factors using a discrete distribution with a finite number of support points and probability weights.

To use discrete factor analysis, first, a likelihood function that includes all of the observed independent and dependent variables used in the system of equations is developed. To build the likelihood function, the contribution to the likelihood function from equation (34) estimating past negative health outcomes for an individual i in community j conditional

upon unobserved factors (μ_{ij}^{E} , ε_{i}^{E}) is:

[34a] $$L_{ij}^{E}\left(\mu_{ij}^{E},\varepsilon_{j}^{E}\right)=P\left(E_{ij}=1\,|\,\mu_{ij}^{E},\varepsilon_{j}^{E}\right)^{(E_{ij})}P\left(E_{ij}=0\,|\,\mu_{ij}^{E},\varepsilon_{j}^{E}\right)^{(1-E_{ij})}$$

where the probabilities on the right hand side of equation [34a] are estimated from from equation (34).

The contribution to the likelihood function for percent Medicaid residents in the facility (equation 33) conditional upon unobserved factors is:

[34b] $$L_{ij}^{PM}\left(\mu_{ij}^{PM},\varepsilon_{j}^{PM}\right)=\frac{1}{\sigma_{\pi}}\phi\left(\frac{PM_{ij}-X_{ij}\beta_{l}^{PM}-E_{ij}\beta^{PM}-\rho_{3}\mu_{ij}^{PM}-\rho_{3\mathrm{PM}}\varepsilon_{j}^{PM}}{\sigma_{\pi}}\right)$$

where ϕ is the standard normal density function and σ_{π}, is the standard deviation of π_{ij}.

The contribution to the likelihood function for the death equation (32) is:

[34c] $$L_{ij}^{M}\left(\mu_{ij}^{M},\varepsilon_{j}^{M}\right)=P\left(M_{ij}=1\,|\,\mu_{ij}^{M},\varepsilon_{j}^{M}\right)^{(M_{ij})}P\left(M_{ij}=0\,|\,\mu_{ij}^{M},\varepsilon_{j}^{M}\right)^{(1-M_{ij})}$$

The contribution to the likelihood function for any of the negative health outcome equation (31) is:

[34d] $$L_{ij}^{T}\left(\mu_{ij}^{T},\varepsilon_{j}^{T}\right)=P\left(T_{ij}=1\,|\,\mu_{ij}^{T},\varepsilon_{j}^{T}\right)^{(T_{ij})}P\left(T_{ij}=0\,|\,\mu_{ij}^{T},\varepsilon_{j}^{T}\right)^{(1-T_{ij})}$$

This likelihood function is conditional on observed and unobserved characteristics at the state, nursing home or individual level. In short, the contribution of an individual *i* in community *j* to the likelihood function, conditional on unobservable factors, is:

[35] $$L_{ij}\left(\mu_{ij}^{T},\mu_{ij}^{M},\mu_{ij}^{PM},\mu_{ij}^{E},\varepsilon_{j}^{T},\varepsilon_{j}^{M},\varepsilon_{j}^{PM},\varepsilon_{j}^{E}\right)=L_{ij}^{T}\left(\mu_{ij}^{T},\varepsilon_{j}^{T}\right)L_{ij}^{M}\left(\mu_{ij}^{M},\varepsilon_{j}^{M}\right)L_{ij}^{PM}\left(\mu_{ij}^{PM},\varepsilon_{j}^{PM}\right)L_{ij}^{E}\left(\mu_{ij}^{E},\varepsilon_{j}^{E}\right)$$

This likelihood function [35] needs to be integrated with respect to the distribution of the unobservable characteristics to obtain the unconditional likelihood function. To accomplish this task, one needs to make assumptions about the distribution of errors attributed due to

these unobservable characteristics. Thus, the accuracy of the estimates obtained depends upon the validity of this distribution assumption. To obtain estimates of this unconditional likelihood function, a nonparameteric discrete approximation to the actual distribution of unobserved characteristics is applied. This technique uses a step function to approximate the cumulative distribution of unobserved characteristics (Heckman and Singer 1984; Mroz and Guilkey 1996). As stated above, this method produces less biased estimates than parametric maximum likelihood methods when the distribution assumptions are incorrect, and when the distribution assumptions are correct, these methods perform as well as parametric maximum likelihood methods (Mroz and Guilkey 1996). The locations and heights of the steps are parameters estimated with other parameters in the system of equations.

Individual *i*'s contribution to the likelihood function unconditional on the effect of individual time-invariant heterogeneity (μ_{ij}) is given as follows. If we assume that individual time-invariant heterogeneity has discrete distribution with 'Q' support points, then the probability of each support point is shown below:

$$[36] \qquad \Pr(\mu_{ij} = \mu_q) = P_q \qquad \text{for } q = 1,2,\ldots,Q$$

Likelihood function:

$$[37] \qquad L_{ij}\left(\varepsilon_j^T, \varepsilon_j^M, \varepsilon_j^{PM}, \varepsilon_j^E\right) = \sum_{q=1}^{Q} P_q \left[L_{ij}^T\left(\mu_{ij}^T, \varepsilon_j^T\right) L_{ij}^M\left(\mu_{ij}^M, \varepsilon_j^M\right) L_{ij}^{PM}\left(\mu_{ij}^{PM}, \varepsilon_j^{PM}\right) L_{ij}^E\left(\mu_{ij}^E, \varepsilon_j^E\right)\right]$$

The estimation procedure used in the analysis resrict the mass points for the discrete distributions to be the same across all equations. This likelihood function can be used to express the contribution of N_j individuals located in market j to the overall likelihood function as given below:

$$[38] \qquad L_j\left(\varepsilon_j^T, \varepsilon_j^M, \varepsilon_j^{PM}, \varepsilon_j^E\right) = \prod_{i=1}^{N_j} L_{ij}\left(\varepsilon_j^T, \varepsilon_j^M, \varepsilon_j^{PM}, \varepsilon_j^E\right)$$

Contribution of individuals in market j to the likelihood function unconditional on market-level heterogeneity (ε_i) is written below. If we assume that market-level time-invariant heterogeneity 'ε_i' has discrete distribution with 'R' support points with probability of each support point is shown below:

[39] $$\Pr(\varepsilon_j = \varepsilon_r) = \pi_r \qquad \text{for } r = 1,2,\ldots,R$$

Likelihood function:

[40] $$L_j = \sum_{r=1}^{R} \pi_r L_j\left(\varepsilon_j^T, \varepsilon_j^M, \varepsilon_j^{PM}, \varepsilon_j^E\right)$$

The unconditional likelihood function can be written for all markets as follows:

Likelihood function:

[41] $$L = \prod_{j=1}^{N_j} L_j$$

This likelihood function is maximized with respect to the unknown parameters in the simultaneous system of equations [31] to [34] along with the parameters used to approximate discrete distributions of unobserved individual- and market-level time-invariant characteristics. In practice, each distribution is approximated by scaled parameters by scaling actual unobserved terms with the corresponding standard deviations. For each distribution, one point of support is fixed at zero and another at one. The other points of support are determined from the data and are restricted between zero and one. This estimation strategy is accomplished using a program developed in FORTRAN. Estimates from single-equation models are used as starting values to maximize the system of equations in this analysis. The FIML model used in this dissertation does not solve the heteroscadasticity problem.

SPECIFICATION TESTS

Because reimbursement rate and its interactions with demand-level variables are highly correlated, a collinearity test is performed. This test indicated that the collinearity is not a problem in any of the equations in the model. White (1980) tests indicate that errors in the percent Medicaid resident equation are heteroscadastic; therefore all the equations are estimated with generalized estimating equations (GEE) to control for heteroscadasticity and error correlation among observations within a cluster (county) (Norton et al. 1996). Several tests are used to ensure that the system addresses possible sources of endogeneity bias and model identification requirements. The potential endogeneity of the percent Medicaid residents and any of the negative outcomes within three months prior to admission are verified using specification tests that rely on two-step instrumental variables estimation methods.

The validity of endogeneity tests requires that the following conditions be satisfied. First, the reduced form models that are used to predict potentially endogenous variables must have significant explanatory power. Second, the instrumental variables used for identification of parameters in the main equation must be correlated with the endogenous variables but uncorrelated with the dependent variable in the respective main equation. The following section provides details on these tests.

Negative outcomes prior to admission. To test for endogeneity of past negative outcomes in the percent Medicaid residents model, a reduced form model of this variable is estimated by a binary logit model using generalized estimating equations (GEE). Then, the predicted probabilities from this model are included in the linear regression model of percent Medicaid residents, replacing the original endogenous dummy variable. A variant of the Hausman

specification test suggested by Spencer and Berk (1981) is used to evaluate possible endogeneity bias by comparing estimates from two alternative specifications of the percent Medicaid residents model: one that uses actual values of past negative outcomes dummy variable under the assumption of no endogeneity (θ_{exog}), and one that replaces the original dummy variable with predicted probabilities from the reduced-form logit model (θ_{end}). The right-hand-side variables in the past negative outcome models include all the variables in the system including all the instruments. The test-statistics follows the chi-square distribution with one degree of freedom.

$$H = [\theta_{end} - \theta_{exog}]^{'} [V_{exog} - V_{end}]^{-1} [\theta_{end} - \theta_{exog}]$$

Results from the reduced-form equation predicting past negative outcome indicate that the model has significant explanatory power. Wald tests reject the null hypothesis that all coefficients are jointly equal to zero (chi-square value of 256.18 with 35 degrees of freedom and $p<0.0001$). Results also indicate that the instrumental variable other past infections is a significant predictor of past negative outcomes ($p<0.0001$). The Spencer and Berk (1981) specification test rejects the null hypothesis that past negative outcome is exogenous in the percent Medicaid resident model ($\chi^2 = 1845.771$ with one degree of freedom and $p<0.001$). Because this model is just identified, we cannot perform an overidentification test. To ensure that the exclusion of other past infections variable from the percent Medicaid model is justifiable, this variable along with predicted values of past negative outcomes is included in the percent Medicaid equation. A Wald test fails to reject the null hypothesis stating that this variable is not a significant predictor of percent Medicaid residents in a nursing home ($p>0.35$).

Because the past negative outcomes variable also enter the two main equations for any of the negative outcomes and death outcomes encountered in the nursing home (see

equations 31 and 32), it becomes essential to test the assumption of endogeneity in these equations as well. First, a bivariate probit model with each of the two main equations are estimated to test whether the errors are correlated. In each case, the bivariate models include all the right-hand-side variables from two equations: one main equation and one with an endogenous variable. Also, the percent Medicaid residents hypothesized to be potentially an endogenous variable in the main equation is replaced with its predicted values from its reduced-form model. Null hypothesis (ρ=0) stating that the error correlation between past negative health outcomes model and current negative outcomes or death in the nursing home during the study period is rejected with p<0.0001 for both cases. This suggests that past any negative health outcomes variable is endogenous in both the current negative health outcomes and death models. A Wald test indicates that all the right hand side variables in the reduced form model of past negative health outcomes have significant explanatory power (chi-square=256.18 with 35 degrees of freedom and p<0.0001). To test for over-identification restrictions imposed in any of the negative health outcomes and death equations, all the instruments but one for each of the two equations are included in respective equations. A Wald test on average number of Medicaid inpatient days per 10 beneficiaries included in any of the past negative health outcomes fails to reject the null hypothesis, indicating that two instruments are not significant predictors of any of the current negative health outcomes (p>0.70). This suggests that instruments used in past negative health outcomes for identifying parameters in any of the negative health outcomes in the nursing home are valid. A similar test conducted for instruments used to identify parameters in death model fails to reject the null hypothesis that the coefficients for these variables are jointly equal to zero (chi-square of 5.82 with five degrees of freedom and p>0.50).

Error correlation between the current negative health outcomes and death outcome in the nursing home models. To test for this, a bivariate probit model that includes all the variables in both the equations along with the predicted values of past negative health outcomes and percent Medicaid residents variables from their respective reduced forms is used. The dependent variables in this model are any of the negative health outcomes and death outcome. A Wald test fails to reject the null hypothesis stating that error correlation between two equations (ρ=0) does not exists (chi-square=0.88 with one degrees of freedom and p=0.35).

Percent Medicaid residents. To test for endogeneity of percent Medicaid residents in the any of the negative health outcomes in the nursing home, a reduced form model of percent Medicaid residents is estimated by linear regression. Because of the presence of heteroscadasticity problem, this model is estimated using the GEE method. This method also controls for error correlation arising due to multiple observations from the same market. The residuals from this reduced form model are included as an additional covariate in the binomial logit model of negative health outcomes in the nursing home. Identification is achieved by including the two instrumental variables in the reduced form model. A Wald test indicates that all the parameters are jointly significant predicators of the percent Medicaid residents (chi-square = 1274.7 with 35 degrees of freedom and p<0.0001). When residuals from the reduced model of percent Medicaid residents are entered in the model of negative health outcomes in the nursing home, the resulting coefficient estimate fails to reject the null hypothesis that percent Medicaid residents is exogenous (t=0.412, d.f.=1, p=0.68). A Wald test indicates that the three instruments (average number of Medicaid inpatient days per 10 Medicaid beneficiaries, past psychological problems and past hypertension problems) are

significant predictors of percent Medicaid residents (chi-square = 6.9 with 3 degrees of freedom and $p<0.10$). To evaluate the validity of over-identifying restrictions, two instruments along with the predicted values of percent Medicaid are included in place of the original endogenous variable in the current negative health outcome model. A Wald test indicates that the instruments are valid (chi-square=0.72 with 2 degrees of freedom and $p>0.7$).

Similar tests are performed to test for endogeneity of percent Medicaid residents in the death in the nursing home model. Specification tests confirm that reduced form of percent Medicaid residents model has substantial power (chi-square=1274.7 with 35 degrees of freedom and $p<0.0001$) and that six instrumental variables are jointly significant predictors of percent Medicaid residents (chi-square=12.89 with 6 degrees of freedom and $p<0.05$). The coefficients of residuals obtained in the first step are statistically significant at 10% level (chi-square = 2.97 with one degrees of freedom and $p<0.085$). This test rejects the null hypothesis that percent Medicaid is exogenous. A test of the over-identifying restrictions indicates that these restrictions are valid (chi-square=4.76 with 5 degrees of freedom and $p>0.45$).

Medicaid Reimbursement Rate, Case Mix and Exit Variables: The Medicaid reimbursement rate, case mix at the facility-level, and exit variables may be endogenous in the models to predict current negative health outcomes, death outcome, and the percent Medicaid residents in the facility. Not accounting for the endogeneity of these variables in the analysis is likely to over- or under-state the direct relationships between the endogenous variables and the respective outcome of interest. The direction of bias depends upon the direction of relationships between the unobserved factors, and the endogenous variable and the outcome

of interest. For example, unobserved staffing intensity per resident in a facility may be positively correlated with the Medicaid reimbursement rate. An increase in staffing intensity per resident may positively affect residents' health outcomes. If it is true and the current analysis does not account for this fact, the estimates are likely to overstate the effect of reimbursement rate on the quality of care measured in terms of residents' health outcomes. Similarly, unobserved competition from community-based and other nursing home alternatives that care for elderly people with less care needs may be positively correlated with a nursing home's case mix. Also, an increase in competition may lead to an improvement in the quality of nursing home care. In such a case, the effect of facility-level case mix on the quality of care may be understated in absolute terms if the analysis does not account for this unobserved factor.

The following tests are conducted to evaluate the endogeneity of Medicaid reimbursement rate and case mix. First, a joint test is conducted to test whether the four variables—Medicaid reimbursement rate and three case mix variables—are endogenous in the current negative health outcome equation. To conduct this test, predicted values of these four variables are obtained from their respective reduced form equations. Then, the current negative health outcome equation is estimated by including these predicted values along with the original four variables and the other variables in the model. An F-test is used to test the hypothesis that the coefficients of all four predicted endogenous variables are equal to zero. If this hypothesis is rejected, it can be concluded that these variables are endogenous. But if this hypothesis is not rejected, all four variables can be treated as exogenous (Gujarati, 1995). This test failed to reject the null hypothesis at 0.15 significance level. Therefore, it is concluded that all the four variables are exogenous in the current negative health outcome

equation. The same test is used to test the exogeneity of these four variables in the Death and Percent Medicaid equations. In both the equations, the test failed to reject the hypothesis that the coefficients of all the four predicted variables are zero. Thus, it is concluded that all the four variables are exogenous in both the equations.

Second, a Hausman specification test (Gujarati, 1995) is conducted to evaluate the endogeneity of each of the four variables separately in the quality equation. To do this, the predicted values of the variable under consideration are estimated using the reduced form of this variable. Then, the current negative health outcome equation is estimated after replacing the original variable with the predicted variable and its residuals. Other suspected endogenous variables are also replaced with their respective predicted values. A t-test is conducted to evaluate whether the coefficient of the residuals is equal to zero. If this test fails to reject the null hypothesis, it is concluded that the variable in question is exogenous. This test is conducted for all the four variables. This test failed to reject the null hypothesis for all four variables ($p<0.15$).

In addition, a test is conducted to examine the endogeneity of the exit variable. To do this, a bivariate probit is estimated using a dummy dependent variable for people who exited before the six month observation time and a dummy variable indicating the occurrence of the current negative health outcome. A t-test on the rho indicating error correlation among two equations is conducted. This test failed to reject the hypothesis stating that error correlation between the exit and current negative health outcome is equal to zero ($p<0.35$). Therefore, it is concluded that the exit variable is exogenous in the current negative health outcome equation. Even so, the results do not change when this variable is included as an additional predictor in the quality equation.

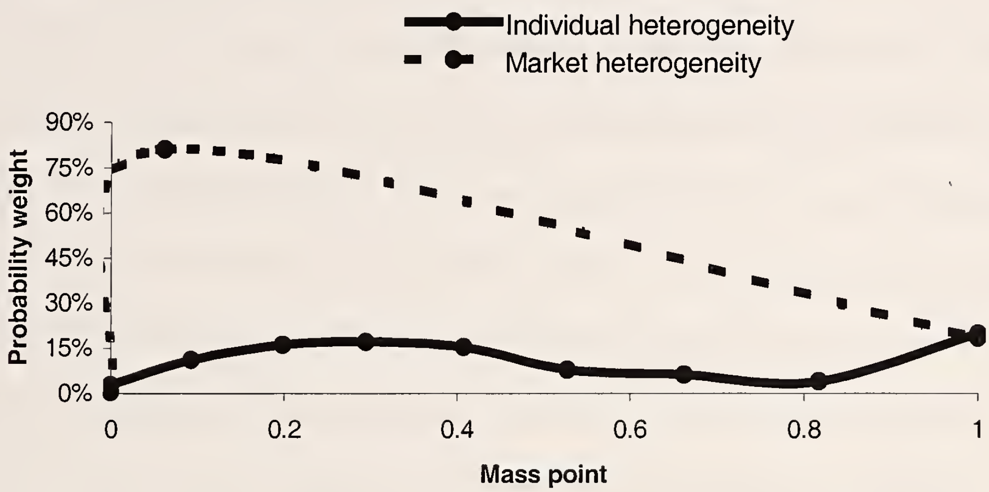
NR^2 tests to evaluate over-identifying restrictions. Another test called NR^2 test is also conducted to evaluate whether the over-identifying restrictions are valid. To conduct this test, each of the main equations is estimated using predicted values of reduced form endogenous variables. Then residuals are constructed in the main equation by subtracting predictions made by using actual values of endogenous variables from the actual dependent variable in the main equation. Because the main dependent variables are binary, it is important to transform all the predetermined variables to take into account of heteroscadasticity and non-linearity. Then, residuals are regressed against all the transformed predetermined variables. Test statistics has chi-square distribution with value $=T \times R^2$, where R^2 (R-squared) is obtained from the regression of residuals and T is the total number of observations. Degrees of freedom in this case are equal to the number of exclusion restrictions minus number of endogenous variables less one. In the current negative health outcomes, this test statistic fails to reject null hypothesis stating that over-identifying restrictions are valid (chi-square=2.2 with 3 degrees of freedom and $p>0.50$). Similarly, this test statistic fails to reject the validity of over-identifying restrictions in the death outcome equation at $p>0.05$.

Points of support. Likelihood ratio tests are used to identify the optimal number of points of support to be used in approximating the unobserved heterogeneity factors (μ and ε). According to Mroz (1997), Monte Carlo studies indicate that this test performs better than alternative tests based on the coefficient estimates for endogenous explanatory variables. In addition, Mroz (1997) suggests that the significance level chosen to conduct this test should be $p=0.25$. To conduct these tests, a model with two points of support each for the individual-level and market-level heterogeneity is chosen as a base model. Then, one point

of support is added in alternate fashion either to individual-level heterogeneity distribution or to the market-level heterogeneity distribution until the tests indicate no significant improvement in the log likelihood value. The chi-square test statistic $2(l_u - l_r)$ is used with degrees of freedom equal to addition parameters estimated in the unrestricted model to test the hypothesis that an additional point of support does not significantly improve the model. These tests indicate that a model with nine points of support for the individual heterogeneity and three points of support for market heterogeneity leads to the optimal specification. These heterogeneity distributions are shown in Figure 3.1.

Endogeneity tests using FIML estimates. To test for endogeneity bias, results from the FIML estimation with discrete factor approximation are used. Two-step method for testing endogeneity does not provide consistent estimates suitable for testing and controlling for endogeneity when both the outcome variable and the endogenous variables are categorical. In these situations, FIML estimation is the only method for testing and controlling for endogeneity. Estimates from the FIML models are used to test for endogeneity due to percent Medicaid residents and past negative health outcomes in the death and the current negative outcomes. Also, these tests are used to test the endogeneity of past negative outcomes in percent Medicaid residents. In addition, error correlation between death and any of the negative outcomes is also tested. To conduct the endogeneity tests, the coefficients for the full system of equations along with heterogeneity terms in the model are estimated. Coefficient estimates for the heterogeneity terms provide a simple test for endogeneity: the variable of interest is exogenous in the main equation if the reduced form equation used to model this variable is uncorrelated with the heterogeneity approximations. This test is

Figure 3.1: Estimated Heterogeneity Distributions for the Model of Any of the Negative Health Outcomes Encountered in the Nursing Home During the Study Period



performed for each of the two potentially endogenous variables in death and any of the negative health outcomes. In addition, the endogeneity of past any of the negative health outcomes in the percent Medicaid residents is also tested.

Past negative health outcomes. The FIML model allows each equation in the system to be correlated with individual-level and market-level heterogeneity approximations. Estimates from this model indicate that any of the current negative health outcomes are positively correlated with individual-level heterogeneity (p<0.001) and negatively correlated with market-level heterogeneity (p<0.001). A Wald test indicates that these two heterogeneity terms are significantly different than zero (p<0.001). The same tests indicate that a death outcome is negatively correlated with individual-level heterogeneity (p<0.12) but uncorrelated with market level heterogeneity (p>0.68) and these two terms are jointly significant at p<0.20. This test further suggests that past negative outcomes is negatively correlated with individual-level heterogeneity (p<0.18) and positively correlated with market-level heterogeneity (p<0.16). These two heterogeneity terms in the past negative outcomes are jointly significant at p<0.20. Estimates also indicate that percent Medicaid residents in a nursing are negatively correlated with individual-level heterogeneity (p<0.001) and positively correlated with market-level heterogeneity (p<0.001). A Wald test suggests that these two terms are jointly different than zero at a significance level less than 0.001. A Wald test rejects the null hypothesis that error-correlation coefficients in past negative health outcomes and current negative health outcomes are jointly equal to zero (p<0.005), and therefore, indicates that the past negative health outcomes is endogenous in the current negative health outcomes equation. A similar test rejects the null hypothesis of exogeneity of past negative health outcomes in death equation (p<0.12). The same test also rejects the null

hypothesis that error-correlation coefficients in past negative health outcomes and percent Medicaid residents are jointly equal to zero ($p<0.001$), and therefore, it concludes that past negative health outcomes is endogenous in percent Medicaid residents.

The validity of these endogeneity tests depends on the appropriateness of the models' identification conditions. Three additional tests for each of the five endogenous cases are conducted. In case of endogeneity of past health outcomes in the percent Medicaid residents in the facility, the following tests are conducted. Because past negative outcome has only one instrument to identify any of the percent Medicaid residents, therefore, this equation is just identified and no over-identification test can be performed. This variable is highly correlated with past negative health outcomes ($p<0.05$). A Wald test rejects the hypothesis that all the variables included in the reduced form model of past negative health outcomes do not explain any variation in past health outcomes significantly (chi-square=220 with df=35 and $p<0.001$). This indicates that the model has substantial explanatory power. To verify the validity of instruments in the past negative health outcome to identify death and the current health outcomes models, Wald tests are conducted in each case. A Wald test rejects the null hypothesis that the two instruments included in past negative health outcome to identify the current negative health outcome model have coefficients that are jointly equal to zero (chi-square = 112 with df=2 and $p<0.001$).

A similar test for instruments in past negative health outcomes model to identify death outcome model rejects null hypothesis that the coefficients are jointly equal to zero with a test statistic of 138 with 6 degrees of freedom and $p<0.001$. To conduct over-identification test, the FIML model is re-estimated with all the instrumental variables less one included in the respective main equations. A Wald test statistic of 0.358 with 1 degree of freedom fails

to reject the null hypothesis that the two instrumental variables have no joint effect in the current negative health outcome model ($p>0.50$). A similar test indicates that over-identifying restrictions in the death model included in the past negative health outcomes model are valid ($p>0.20$).

Error correlation between death and any of the negative health outcomes. To evaluate whether the error-correlation between death and any of the negative health outcomes is statistically significant, a Wald test rejects the null hypothesis that four heterogeneity parameters in total in both equations are jointly equal to zero ($p<0.005$). It suggests that unobserved factors affecting death also affect any of the negative health outcomes and that the two models should be estimated jointly. For identification purposes, a few variables that are included in one equation are excluded from the other. For example, the death outcome model includes the past psychological problems variable but this variable is excluded from the current negative health outcomes model. Similarly, the variables indicating bowel and bladder problems, diabetes, muscluskeletal problems, osteoporosis or parkinsonism in the three months prior to admission are excluded from the death outcome model but are included in the current negative health outcomes model.

Percent Medicaid residents. The joint test to evaluate the endogeneity of percent Medicaid in the current negative health outcomes model rejects the null hypothesis that all four heterogeneity parameters in the two equations are jointly equal to zero ($p<0.001$) suggesting that the percent Medicaid is endogenous in this model. A similar test suggests that the percent Medicaid residents is endogenous in the death model ($p<0.001$). To validate these tests, the following additional tests are conducted. A test statistic of 334 with 35 degrees of freedom rejects the null hypothesis that the coefficients of all the right-hand-side variables in

the reduced form model of percent Medicaid residents are jointly equal to zero ($p<0.001$). A Wald test suggests that the coefficients of three instruments included in the percent Medicaid residents to identify coefficients in the current negative health outcome model are jointly equal to zero ($p<0.005$). A similar test also rejects the null hypothesis that the coefficients of six instruments in the percent Medicaid residents model to identify the death outcome model are jointly equal to zero ($p<0.005$). A test statistic of 8.48 with 5 degrees of freedom suggests that five instrumental variables have no effect in the death outcome model ($p>0.10$). A similar test fails to reject the null hypothesis over identifying restrictions in the current negative health outcome model included in the percent Medicaid residents are valid ($p>0.10$).

These specification tests provide further evidence that past negative outcome is endogenous in the rest of the four equations in the system and that percent Medicaid is endogenous in the death outcome and current outcome equations. Further, these tests provide evidence of the error correlation between the death outcome and current outcome models. As a result of these tests, it becomes necessary to estimate these equations simultaneously.

HYPOTHESIS TESTS:

The following hypotheses are examined in the death and current negative health outcome equations: First, OBRA 87 regulation-required increases in quality standards are hypothesized to have a negative effect on the quality of nursing home care, under the assumption that these standards increase the costs of care but do not have any effect on the quality of care. This will force nursing homes to divert resources from the activities that directly affect quality. If the regulation-required standards do not enhance quality of care,

then the OBRA 87 dummy variable is expected to have a positive relationship with the outcome variables that measure quality negatively. A simple Wald test is used to evaluate this hypothesis, under the null hypothesis that the coefficient associated with the OBRA 87 variable in both the death and current negative health outcome equations [31] and [32] is zero. Second, OBRA 87 regulation is hypothesized to have a positive effect on the percent Medicaid residents in the facility. Because OBRA 87 regulation affects quality of care negatively, that in turn will divert potential private paying nursing home users away from nursing homes to alternate settings. Thus, it is expected that the proportion of Medicaid residents in nursing homes will increase after OBRA 87. A simple Wald test is used to evaluate this effect. Third, the market competitiveness is hypothesized to affect the quality of care positively, irrespective of market conditions. A Wald test that accounts for non-linearity is used to test this hypothesis. It is performed in both the death as well as current negative outcome equations. The coefficient of high competition dummy variables is expected to be negative and significant but the coefficient of its interaction term with high demand is expected to be non-significant. Fourth, it is hypothesized that market competitiveness is negatively related to the percent Medicaid residents in the nursing home irrespective of levels market demand. A Wald test is conducted to examine the null hypothesis that the coefficients of high competition and its interaction with high demand are jointly and individually equal to zero. Fifth, the Medicaid reimbursement rate is hypothesized to have a negative effect on quality in high demand markets and a positive effect in low demand markets. A simple Wald test is conducted on the coefficient of the Medicaid reimbursement rate and its interaction term with respective demand level in both the death and current negative health outcomes to test these hypotheses. To account for non-

linearity, another Wald test is also performed. Sixth, Medicaid reimbursement rate is hypothesized to have a positive relationship with the percent Medicaid residents in nursing homes in excess demand markets. On the contrary, the Medicaid reimbursement rate is expected to have a negative effect on the percent Medicaid residents in nursing homes located in excess capacity markets. Wald tests are conducted on the joint significance of the coefficients of the Medicaid rate and its interaction with respective demand level to examine these hypotheses.

VARIABLES:

Dependent Variables

This study uses the variables listed in Table 3.1. Statistical methods seek to measure the changes in quality of nursing home care after the implementation of OBRA 1987 regulations. The quality of care can be measured in terms of structure, process, and outcome (Davis 1991). Outcome measures are widely regarded as the gold standard (Kane et al. 1988; Lohr 1988). In this study, the quality is measured in terms of residents' health outcomes during their stay in nursing homes, after taking into account the effect of unobserved individual- and market-level time-invariant heterogeneity. Bedsores are one of the problems most frequently identified among nursing home residents (Health Care Financing Administration Report, 1998, pp 26). Ulcers, urinary tract infections, and dehydration are part of the key indicators for quality listed by Institute of Medicine report in 1986. Poor nutrition, dehydration, improper care of bowel and bladder incontinence, and bed-fast residents can result in bedsores or urinary tract infections, which if not properly treated, can lead to more serious infections and death (GAO 1998). Because the quality of nursing home care can affect various individual resident's health outcomes, it seems reasonable to look at a combination of

multiple health outcomes as a measure of quality of nursing home care. The negative health outcomes of interest in this study are pressure sores, infections, urinary tract infections, dehydration, malnutrition, weight loss and any injury related to falls occurring within six months of admission to a nursing home. The outcome of interest is the occurrence of any of these outcomes during the study period. In addition, death is also measured. These two outcomes are used as indicators of nursing home quality of care. The list of negative health outcomes with corresponding ICD9 codes is given in Table 3.2.

The dependent variables in quality equations are a set of two binary variables indicating the occurrence of any of the negative health outcomes as well as death during an individual's stay in the nursing home. It can be argued that death is often anticipated in the nursing home. Therefore, it is not being used as the main indicator of nursing home quality of care in this analysis. The analysis uses the negative health outcomes like bedsores, malnutrition, urinary-tract infection, other infections or dehydration aside from death occurred in the nursing homes as the main quality indicator. However, there exists a difference in death rates among nursing homes. This variation in death rates among nursing homes may be due to the differences among nursing homes in the extent of neglect and abuse of residents. Therefore, the level of quality of care can reduce or increase the likelihood of death. For example, the USGAO (1998) reported to Congress that "California nursing homes have not been and currently are not sufficiently monitored to guarantee the safety and welfare of their residents." This report indicates that approximately 33 percent of the homes were cited by the state surveyors for having serious or potentially life-threatening care problems. The USGAO (1998) also report that a majority of the medical records of sample of 62 residents who had died indicated that these people received poor care that endangered their health and

safety. Given some evidence of greater death rates with low quality of care, a comprehensive analysis should look at death but must be cautious in terms of inferences and interpretations. Therefore, this analysis uses death as an additional and not the only measure of quality of nursing home care. The respondents were followed over a period of six months from the time of their admission into a nursing home.

This analysis models nursing home residents' outcomes as a non-parametric function of patient's demographic characteristics, various measures of health status at, before and after the time of admission to nursing home, and nursing home, market and state characteristics. In addition, the proportion of Medicaid residents in the facility, a continuous variable, is used as a dependent variable in the proportion Medicaid equation (Equation 34). The proportion Medicaid residents in the facility is used as an indicator of Medicaid population's access to nursing home care. On average, there are 50.18 percent Medicaid residents in the facilities included in this study. Because it is hypothesized that some common unobserved factors that affect the current negative health outcomes also affect death, it becomes important to estimate the death outcome in the system. In fact, many studies have used death as an additional measure of quality (Spector et al., 1998). In addition, it is hypothesized that common unobserved factors that affect past negative health outcomes also affect the current negative health outcomes. Therefore, any of the negative health outcomes is also estimated in the system of simultaneous equations. The death and the current negative health outcomes in the past three months prior to admission into a nursing home equations (Equations 32 and 33) will have binary variables—one indicating the occurrence of death in a given time period, and another will indicating whether the person had encountered the negative health outcomes in the past three months. Sixteen percent of the sampled individuals died within

Table 3.2: List of Negative Health Outcomes With Corresponding ICD9 Codes

S.No.	Disease Type	ICD9 Codes (If primary or secondary diagnosis start with following three digits)	ICD9 Codes (if primary or secondary diagnosis match the following codes)
1.	Bedsores		7070, 7854, 7078,7071
2.	Cellulitis	035	6829, 0400, 6826, 6823, 6822, 6825, 68110, 68100, 6820, 6824
3.	Urinary-Tract Infection	599	595, 5950, 5958, 59589, 5959, 5990, 59581, 59582, 59780, 59789, 59389, 5970, 597, 5978, 59781, 59589, 0980, 0982, 13100
4.	Injuries	E865, E880-E888, E925, E919, E920	9592, 9591, 9009, 90082, 90089, 9048, 9009, 9029, 90287, 90289, 9590, 9593, 9597, 9596, 9594, 8540, 8530, 8518, 8520, 8522, 71885, 71886, 71883, 82100, 82003, 82013, 82121, 82131, 82001, 82011, 82122, 82132, 82009, 82019, 82120, 82129, 82139, 82123, 82133, 82131, 8208, 82020, 82030, 82021, 82031, 82000, 82010, 82012, 8209, 73314, 73315, 82009, 82019, 82002, 82110, 82030, 82101, 82111, 82022, 82032, 82001, 8208, 8209, 82381, 82382, 82392, 8248, 8249, 8242, 8243, 82391, 73316, 82321, 82322, 82331, 82301, 82302, 82312, 82311, 81380, 82520, 82530, 81340, 81350, 81390, 81320, 81300, 81310, E904.0, E900.0, E924.0, E900.1, E924.2, E879.8, E904.0,
5.	Dehydration		276, 2760, 2761, 2765, 2769, 2768, E904.2
6.	Weightloss		7832
7.	Malnutrition	260, 261, 262, 264	263, 2630, 2631, 2632, 2638, 2639, 2691, 2692, 2693, 2698, 2699, E904.1,
3.	Infections	0030, 0031, 00322, 0040, 0091, 0092, 0093, 0050, 0051, 0052, 0053, 00581, 00589, 0380, 0381, 0382, 0383, 03840, 03841, 0059, 03842, 03843, 03844, 03849, 0389, 0770, 0771, 0772, 0773, 0774, 0778, 0779, 07798, 07799, 3230, 3231, 3232, 3233, 3234, 38010, 5980	481-486, 681, 684, 686, 711, 590, 487, 320, 321

the study period. In addition, sampled individuals who experienced any past negative health outcomes represent 53.9 percent of the sample. If an individual dies or is discharged within six months, then that individual is not followed any more.

Explanatory Variables Used in the Models

Each of the equations in the simultaneous equation system estimated in this study uses explanatory variables that can be grouped into six categories: (1) endogenous variables; (2) policy variables; (3) sampled individuals' characteristics; (4) nursing home characteristics; (5) market characteristics; and (6) exclusion restrictions.

Endogenous Variables.

Any of the Negative Health Outcomes before Admission. It is hypothesized that individuals with a history of a given health problem are more likely to have the same problem in the future. Therefore, a dummy variable is constructed to control this effect. This variable is set to 1 if an individual experienced any of the negative health outcomes within three months prior to the sampled admission. Also, it is believed that common unobserved factors that affect an individual's past negative outcome also affect that individual's likelihood of experiencing the same problems or death. In addition, it is hypothesized that individuals with past problems are more likely to enter a nursing home with a higher percent of Medicaid residents. These individuals are expected to experience an unexpected need for nursing home services that will force them to choose a nursing home without having sufficient information.

Proportion Medicaid Residents in the Nursing Home. It is hypothesized that a higher percent of Medicaid residents in a nursing home is associated with poor quality of nursing home

services. Because private price is higher than the Medicaid per diem, private paying residents are more desired by a profit maximizing nursing home. In addition, the private paying residents are expected to be more conscious in weighing the costs and benefits of entering a nursing home compared to Medicaid subsidized residents. Therefore, private paying prospective nursing home residents are more likely to enter a nursing home with higher quality of care than the Medicaid population. Further, a nursing home providing higher quality is likely to have a higher marginal cost of care and is more likely to accept fewer Medicaid residents. Therefore, it can be concluded that the nursing homes with higher access to Medicaid residents are on the average expected to have poorer quality. This does not mean that all the nursing homes with higher percent of Medicaid residents provide poorer quality of care compared to the one with lower of Medicaid residents. But on average, a nursing home with higher percent of Medicaid residents is expected to provide poorer quality than its counterpart with lower percent of Medicaid residents. Thus, the coefficient of this variable is expected to have a positive coefficient in each of the death and current negative health outcome equations.

Policy Variables

Omnibus Reconciliation Act of 1987 (OBRA 87). The primary explanatory variable of interest is the timing of implementation of OBRA 87 regulation that enforced quality standards among nursing homes. This study uses a dummy variable to indicate the timing of implementation of this regulation. If an individual is admitted before October 1990, then this variable is set to zero. Otherwise, this variable is equal to one. The theoretical model examined in chapter two suggests that this regulation affects quality of care and Medicaid population's access to nursing home care. It is hypothesized that OBRA 1987 regulation

required increases in minimum quality standards increase an individual's risk of encountering the current negative health outcomes (e.g. bedsore, urinary-tract infection, other infections, malnutrition, weightloss or injuries) and death outcome. This conclusion is based on the assumption that this regulation required increases in minimum quality standards require a nursing home to increase input resources without an appropriate monetary compensation by the government. Thus, a nursing home is likely to meet new requirements at the expense of care needed in other areas. This reduction in the resources in other areas may increase a nursing home resident's likelihood of encountering the current negative health outcomes and death outcome that are used as measures of quality of care. This quality is measured in terms of the likelihood of a nursing home resident encountering negative health outcomes. Therefore, the dummy variable representing an admission after the implementation of this regulation is expected to have a positive sign in equations predicting the current negative health outcomes and death outcome.

Also, it is hypothesized to have a positive effect on the percent Medicaid residents in the facility as well as the severity levels of individuals entering nursing homes.

Market Demand. Three dummy variables are constructed to indicate demand level in the market using the ratio of occupied beds to total beds in the market. Three cutoff points are chosen in manner that ensures approximately equal number of observations in three demand levels and are reasonable measure of corresponding demand levels. If this ratio is greater than or equal to 0.93, lies between 0.93 and 0.83 or less than 0.83, then the dummy variables indicating high, moderate and low demand are coded 1 respectively. Elsewhere, these variables are coded zero. This quality is expected to decrease with increases in demand

level. Any increase in demand is positively related to the percent Medicaid residents in the facility. Moderate demand is the omitted category.

Market Competitiveness. In an excess demand area, nursing homes may compete for private-paying residents on price and quality (Nyman 1988a). In low demand areas or areas with high competition, nursing homes may compete on both price and quality. A nursing home faces competition not only from other nursing homes but also from other providers providing formal and informal elder care. These other providers include agencies like home health care providing formal care, and informal care provided by family and friends. Given the data available for this study, competition in a given market from other nursing homes and from potential informal care providers is accounted for in this analysis. Competition from other formal care providers is unobserved and is accounted for by the estimation technique used in this study. Market competition among the nursing homes is defined by the Hirschman-Herfindahl index (HHI). The Herfindahl Index is constructed based on market shares measured in terms of number of residents of all nursing facilities in the county. To develop this index, all nursing homes in a given market owned by the same owner are collapsed into one entity. To account for the nonlinear effect of market competition, high market competition is indicated by a dummy variable. If HHI is less than equal or to 0.10, then the high market competition dummy variable is set to 1. Else where, this variable is set equal to zero. Competition from potential informal care providers is accounted for by two market level variables: (1) Non-working women over 15 years of age per thousand people aged over 75 population in the market (county); and (2) Medicaid population per elderly (65 years and over age) in the market. In general, individuals on Medicaid are expected to have either very low wages or no income. Therefore, their opportunity cost of providing formal or

informal care is lower compared to those not covered by Medicaid. Therefore, people on Medicaid are more willing than people not on Medicaid to provide formal or informal care to elderly people. Also, an elderly individual may prefer to receive care at home than in the nursing home. This means that as the Medicaid population per elderly in a market increases, an elderly is more likely to receive formal or informal care at home that is going to be cheaper than nursing home care. Thus, a nursing home may have to compete for residents as the Medicaid population per elderly increases in the market.

The theoretical model presented in chapter two suggests that the quality of care improves with an increase in the level of market competition irrespective of market demand level. To account for the counter effect that non-profit nursing homes have on quality, this study includes an additional explanatory variable equal to the proportion of beds owned by for-profit nursing homes in the market. Because the dominance of for-profit nursing homes is expected to reduce quality, this variable is hypothesized to have a positive relationship with death and any of the negative outcomes, and it is going to be positively related to percent Medicaid residents in the nursing home.

Medicaid Reimbursement Rate. To explore a nonlinear effect of Medicaid reimbursement rate, the Medicaid reimbursement rate variable is cosntructed as the actual Medicaid reimbursement rate less 65.5. The Medicaid reimbursement rate is the average number of dollars reimbursed per day per nursing home Medicaid-eligible resident in the state in the given particular year. By subtracting the mean from the variable, the interpretation of the estimates become easier. Later on, this idea was dropped. But the transformed variable was not dropped as it was not expected to affect my analysis.

In some states, the rate can vary between a hospital- and non-hospital-based facility, by the case mix of a facility or whether a facility is skilled nursing versus intermediate nursing facilities. In this study, Medicaid reimbursement rate is the average Medicaid reimbursement rate. It may be argued that the reimbursement rate can cause endogeneity. To my knowledge and understanding, it will be a problem if we omit facility- and resident-level case mix. In this case, it may not be a significant problem in this analysis for the following reasons. First, most of these rates are based on the cost experiences of nursing home facilities in the current (if cost based or case mix based) or prior year or combination based. All else equal, the major contribution of this variation results from the facility- and individual-level case severity. Second, another cause of this variation results from the variation in reimbursement rates by facility type (skilled vs. intermediate vs. hospital based). Third, the differences in final payments to different facilities of similar type are expected to be minimal after accounting for facility- and resident-level case mix.

Given the fact that the individuals in this study entered as Medicare eligible, most of these individuals probably went to similar facilities. In addition, this analysis controlled for facility- and individual-level case mix. Also, it was found that including different payment methods and facility types in the analysis did not produce any substantial differences in the results. Therefore, these variables were dropped. Further, the endogeneity test, as stated in failed to establish that Medicaid reimbursement rate is endogenous in the current negative health outcome, death outcome, and percent Medicaid nursing home residents equations.

High Competition High Demand Interaction. Bresnahan and Reiss (1991) find a nonlinear relationship between the degree of competition and the number of firms in the markets. According to them, a monopolist faces a downward sloping inelastic demand curve

and reaps profits by setting marginal revenue equal to marginal costs. Because at any given point marginal revenue curve is below the average revenue or demand curve, a monopolist charges prices higher than its marginal costs. With the increases in the market demand, a monopolist's profits also increase, which then increases the possibility of new firms entering the market. With the entry of new firms, the incumbent firm's demand becomes elastic and its profit margin falls. The profit margins will approach competitive levels at a decreasing rate with the entry of each new firm. Their empirical analysis suggests that the competitive effect of each additional firm in the market reduces with the number of firms already in the market. Dranove et al. (1998) in their analyses of managed care penetration in the markets allowed the intercept and slope of explanatory variables to vary between high and low concentration markets. A dummy variable indicating interaction between high competition and high demand is set equal to 1 if the market has both a high competition and a high demand for nursing home services. The theory examined earlier suggests that quality of care will increase with competition irrespective of market demand conditions. Therefore, the high competition dummy variable is hypothesized to have a positive relationship with quality. Thus, the coefficient is expected to be negative in both the death as well as current negative health outcome equations. The relationship between the interaction of high demand and high competition, and quality is undetermined. It is also hypothesized that high competition is negatively related to the percent Medicaid residents, while its interaction term has an undetermined relationship with percent Medicaid residents in the nursing home.

High Demand and Medicaid Reimbursement Rate. This variable is equal to the Medicaid reimbursement rate in markets with high demand. It is hypothesized to have a negative relationship with quality. Therefore, the coefficient is expected to be positive in

both the death and current negative health outcome equations. Also, it is hypothesized to have a positive effect on the percent Medicaid residents in the nursing home.

Low Demand and Medicaid Reimbursement Rate. This variable is equal to the Medicaid reimbursement rate in markets with low demand. This variable is hypothesized to have a positive relationship with the quality of care and a negative relationship to the percent Medicaid residents in the facility. Therefore, the coefficient of this interaction term is expected to have a negative sign in the death and current negative health outcome equations.

Sampled Individuals' Characteristics. The sampled individuals' characteristics like gender, race, and age at the time of nursing home admission are expected to affect their health outcomes. An individual's age is used as a continuous variable. In this analysis, age is indicated as actual age less 70. With age, an individual is more likely to have any current negative health outcomes or die. Similarly, older people are more likely to go into nursing homes with lower percent Medicaid residents for two reasons; first, with age, an individual is more informed about nursing homes due to increased anticipated entry into a nursing home; and second, with age, an individual is less likely to require nursing home care in an emergent situation. The gender of the sampled individual is shown by a dummy variable, which is set to 1, if the individual is male. This variable is expected to have a negative relationship with the percent Medicaid residents in the nursing home. Because males are on the average have poorer health than females, they are more likely to encounter current negative health outcomes in the nursing home. A dummy variable, black, indicating the race of the sampled person is hypothesized to have a positive relationship with both the negative health outcomes and death. Blacks are more likely to be on Medicaid than Whites. Thus, they are more likely

to enter a nursing home with a higher percent of Medicaid residents. Other individual-level dummy variables indicating an individual's health status within three months prior to admission are constructed. These are dementia and Alzheimer's diseases, any of the heart diseases, cancer, circulatory diseases, and chronic obstructive pulmonary diseases and respiratory problems. An individual having any of these past health problems has a higher probability of dying. Similarly, an individual having any of these past health problems except cancer is more likely to encounter any of the negative health problems. The list of diseases with corresponding ICD9 codes is listed in Table 3.3.

Nursing Home Characteristics

To control for the effect of ownership type on nursing home quality, a dummy variable is used. Incentives to provide better quality varies with nursing home ownership type, with nonprofit homes providing better quality care (Chou, 1998). Because of the higher quality of care provided by non-profit nursing homes, it is expected that these nursing homes attract more private paying residents than the for-profit nursing homes. Therefore, non-profit ownership is hypothesized to a have negative relationship with the percent Medicaid residents in the facility. Nursing home quality of care is affected by the case-mix of its residents. Therefore, three continuous indices representing case-severity at the nursing home level are computed. Two indices represent the level of mobility and specialized care required by the nursing home residents. The mobility index is constructed using the information on the level of assistance required by the residents in eating, toileting, transferring and moving. The specialized care index indicates the proportion of residents requiring respiratory care, suctioning, intravenous therapy, tracheostomy care and parenteral feeding. These two

Table 3.3. Health Outcomes used as controlling conditions with Corresponding ICD9 Codes

S.No.	Disease Type	ICD9 Codes (If primary or secondary diagnosis start with following three digits)	ICD9 Codes (if primary or secondary diagnosis match the following codes)
1.	Osteoporosis		7330, 73300, 73301, 73302, 73303, 73309, 7337, 7310, 2682
2.	Parkinson's Disease	332	3330, 09482
3.	Bowel Incontinence		7876, 78834, 78837, 30011, 3077, 78833, 78839, 6256, 78832
4.	Arthritis	713-716, 720-721	6960, 7193
5.	Cancer	140-208, 233, 235-239	2592, 2328
6.	Chronic Obstructive Pulmonary Disease	490-496	
7.	Dementia	290, 319, 340, 303, 330	2948, 2912, 2903, 0941, 09040, 29040, 2900, 29282, 2990, 2939, 2941, 4460, 2991, 3301, 3459, 2751, 3334, 0461, 0949, 3311, 4460, 3339
8.	Diabetes	250	3581, 2518, 2535, 2714, 5881, 2750, 7902, 9620
9.	Paraplegic		3441, 3440, 3442, 78001, 78003
10.	Mental Retardation	317-319	
11.	Alzheimer's Disease	331	
12.	Schizophrenia	295	
13.	Psychosis	298	
14.	Heart Disease	390-400, 415-427, 429-435, 440-441	
15.	Hypertension	401-405	
16.	Heart Failure	428	
17.	Stroke	436-438, 342, 344	
18.	Ischemic Heart	410-414	
19.	Respiratory	460-519	
20.	Circulatory	406-409, 439, 448-459	
21.		710, 712, 717-718, 722-739	
22.	Bladder Incontinence		7882, 78820, 78821, 78829, 7883, 78830, 78831, 78832, 78833, 78839, 59984, 6256, 3076
23.	Other Infections	001-002, 006-034, 036-037 039-139, 680, 682, 683, 685	

indices have been used by Cowles (1995). Another care index variable indicating the prevalence of incontinence and skin problems is calculated using a case mix developed by Thoms (1975) based on time and motion studies. The weights in Thoms's system represented the expected minutes of care required on a daily basis for patients requiring specific procedures or with certain levels of functional deficits. Dor (1989) and Cohen and Dubay (1990) have used this to account for the facility level case mix. These indexes are treated as exogenous because the exogeneity as well as simultaneity tests of these variables in outcome equations do not reject the null hypothesis stating that these variables are exogenous. Similarly, I failed to reject null hypothesis stating that these variables are exogenous in the percent Medicaid equation. Three case-mix variables are computed as follows:

Mobility =	[proportion of residents totally dependent at eating*3] + [proportion of residents requiring extensive assistance with eating*3] + [proportion of residents requiring limited assistance with eating*2] + [proportion of residents requiring supervision while eating] + [proportion of residents independent at eating] + [proportion of residents totally dependent at toileting*5] + [proportion of residents requiring extensive assistance with toileting*4] + [proportion of residents requiring limited assistance with toileting*3] + [proportion of residents requiring supervision while toileting] + [proportion of residents requiring no assistance with toileting] + [proportion of residents totally dependent at transferring*5] + [proportion of residents requiring extensive assistance with transferring*4] + [proportion of residents requiring limited assistance with transferring*3] + [proportion of residents requiring supervision while transferring] + [proportion of residents independent at transferring] + [proportion of residents who are bedfast*5] + [proportion of residents who are chairbound*3] + [proportion of residents who are ambulatory]
Specialized Care =	[proportion of residents receiving respiratory care] + [proportion of residents receiving suctioning] + [proportion of residents receiving intravenous therapy and/or blood transfusion] + [proportion of residents receiving tracheostomy care] + [proportion of residents receiving parenteral feeding]
Other Care =	[proportion of residents with indwelling catheters*20] + [proportion of residents who are incontinent (bowel + bladder)*48 + [proportion of residents receiving bowel and/or bladder training*26] + [proportion of residents receiving special skin care*10]

Area Characteristics

Area characteristics may influence nursing home quality directly or indirectly (Chou, 1998). Market areas characteristics that may affect nursing home quality and access to nursing home care for the Medicaid population are rural or urban status of the market, level of demand for nursing home care, health severity of potential entrants, potential demand for nursing home care, and potential profitability from Medicaid residents. Since access to health services is higher in urban than in rural areas, urban status is expected to a have positive relationship with quality. Therefore, the coefficient of this is expected to have a negative sign in both the death and current negative outcome equations. Because of the greater availability of nursing home care for the Medicaid population in urban area, an individual in an urban area who is entering a nursing home is expected to enter a nursing home with lower percent of Medicaid residents. Higher female proportions among the 75 and older population suggest two things: (1) Because females are expected to have fewer earning resources and fewer assets, a higher percent of elderly population is expect to be on Medicaid. This means that an elderly person from such markets is more likely to enter a nursing home with higher percent of Medicaid residents; (2) more availability of informal care. This suggests that an individual from such markets is more likely to demand nursing home services only when his/her health has deteriorated severely. Therefore, this variable is expected to have a positive relationship with death and any of the negative health outcomes. A variable indicating level of demand for skilled nursing care is defined as the average number of Medicare inpatient days per 10 beneficiaries. Medicare covers nursing home care for people who have stayed in the hospital for at least three days. In general, these people experience a sudden health shock and require rehabilitative care. Due their restrictive

movement or ability to perform daily activities of live, such individuals are more likely to have falls related injuries and weight loss. Otherwise, these individuals are healthy and they are less likely to die. These individuals require skilled nursing care immediately after their discharge and are more likely to enter a nursing home with higher proportion of Medicaid residents. Therefore, this variable is expected to a have positive relationship to the current negative health outcomes and the percent Medicaid residents in the facility. This variable is hypothesized to have a negative relationship with the death outcome.

To account for the potential profitability of potential nursing home residents or costliness of input resources, this study tried to use the Heath Care Financing Administration's metropolitan statistical area level hospital wage index, an indicator of costliness of input resources. This analysis includes observations from 1984 to 1995 and the wage index is missing for many counties especially for earlier years. I tried to impute for quite a few of the counties but I could not do so for many counties for lack of relevant information. In addition, HCFA does not provide this rate for non-SMSA regions that form a vast part of the US. Therefore, I did not include this variable in the analysis. Another variable that can be an indicator of potential profitability of Medicaid residents is constructed. This variable is defined as the number of services covered by the Medicaid reimbursement rate. Certain kinds of services are covered by the prospective reimbursement rate irrespective of whether a nursing home rendered all or any of these services to a given resident. Medicaid reimburses nursing homes for services not covered by the rate separately. All else equal, if the Medicaid reimbursement covers more services, the reimbursement rate is expected to go up to cover the cost of these services. Also Medicaid covered nursing home resident, on average, may not use all the services covered by the Medicaid rate. The

difference in the number of services covered and the number of services actually utilized is expected to occur more often as the number of covered services increases. Thus, a Medicaid resident becomes more profitable as the number of services covered by the Medicaid rate increases. In such a case, nursing homes are expected to be more willing to admit Medicaid-covered elderly individuals. With expected extra monetary resources, nursing homes are expected to enhance quality to attract potential customers. Thus, it is concluded that an increase in the number of services is positively related to both quality and access to nursing home care.

Exclusion Restrictions. Several individual-level and one market-level variables are used as exclusion restrictions to achieve identification in the simultaneous equation system estimated in the current analysis. The variables indicating that an individual has been diagnosed for bowel or bladder incontinence, diabetes, musculoskeletal disorders, osteoporosis, or Parkinson's disease are excluded from the death equation but included in the negative health outcomes encountered in the nursing home.

Multiple chronic conditions are common among elderly persons (Fried and Wallace, 1992). In general, variables like bowel or bladder incontinence, diabetes, musculoskeletal disorders, osteoporosis, or Parkinson's diseases affect the likelihood of a person's death through other intervening health conditions. As shown in the discussion below, a few of these variables may have direct but not appreciable effect on a person's likelihood of death. However, the medical literature suggests that most of these variables are directly related to a person's likelihood of encountering any of the negative health outcomes other than death in the nursing home. A summary of this medical literature follows.

Urinary incontinence has been associated with several medical conditions, including fecal incontinence, neurological disease, depression, Parkinson's disease, dementia, diabetes, urinary tract infections, cardiovascular disease and cerebrovascular disease (Cambell et al., 1985; Eberle et al., 1993; Ouslander et al., 1993; Sultana et al., 1997; Thom et al., 1997; Molander et al., 1999; Rosebud et al., 1999). It is believed to be an important cause of admission to long-term care facilities (Ouslander, 1981). After adjustment for co-morbid conditions, Thom and colleagues (1997) found a non-significant increase for women and a significant but a small increase in risk of dying for men. A study by Herzog and colleagues (1994) found no association between incontinence and risk of death after adjusting for age, education, number of medical conditions and self-assessed health status. Lewis and colleagues (1985) also reported that incontinence is not an important risk factor for mortality in the long run. Nakanishi and colleagues (1999) found non-significant association between minor or moderate incontinence and mortality. They did find a significant relation between severe incontinence and mortality. It may be that the co-morbid disease conditions mediate the relation between incontinence and mortality. According to Campbell and colleagues (1985), urinary incontinence as a predictor of death is probably a marker of condition such as dementia, poor mobility and poor physical health rather than a risk factor on its own right. Nelson and colleague (1998) state that physical disability and poor general health are commonly associated with fecal incontinent. An individual with bowel or bladder incontinence is expected to have wet skin more often than the individual not having bowel and bladder problem. Wet skin can lead to the development of bedsores and other kinds of infections. Fecal incontinence has been associated with pressure ulcers and diarrhea (Nelson et al., 1998; Schnelle et al., 1997; Brandeis et al., 1994). Brown and colleagues (2000)

concluded that the urinary incontinence is associated with an increased risk of falls and fractures.

According to McGuire and colleagues (1997), Type II diabetes mellitus is one of the most prevalent diseases in the world affecting more than 100 million people. Almost 20% of the diabetic patients had multiple complications (Morgan et al., 2000). Diabetes is associated with substantial morbidity and mortality rates relating mostly to macrovascular disease. Diabetic patients have a 2 to 3 fold increased risk for cardiovascular disease (CVD) compared with the non-diabetic individuals. In particular, this relation holds true for ischemic heart disease and coronary artery disease (McGuire, 1999). More than 50% of diabetic patients have CVD diagnosis and 80% of the deaths among diabetic patients are due to CVD (Goldberg, 2000). Baxter and colleagues (1992) attribute excess mortality among nursing home diabetic residents in their study to Cardiovascular accidents and ischemic heart disease. Myocardial infarction is also a common cause of mortality in people with diabetes (Fisher, 1999). Diabetes mellitus acts as a strong risk factor for illness and death due to coronary heart disease (Agostoni et al., 2000). For diabetic persons, the relative rate of stroke mortality was higher than that for stroke incidence for both men and women. But the difference in rates of stroke incidence and mortality were non-significant (Hart et al., 2000). The literature to date on patients with diabetes and acute Myocardial infarction concludes that the common cause of death in this population is due to myocardial pump failure (Malmberg et al., 1999).

The excess mortality among diabetes patients declines with age (Wong et al., 1991). A non-significant difference in death rates between older diabetic and non-diabetic patients was observed in some studies (Rosenthal et al., 1998; Wong et al., 1991; Panzram and Zabel-

Langhenning, 1981). For women and very older males (80 years and older), no difference in mortality between diabetic patients and respective Danish population is observed (Olivarius and Andreasen, 1997). But they found a statistically significant excess mortality, only after 4 years of diagnosis, among younger male diabetic patients compared to their counterparts in the Danish population. Morricone and colleagues (1999) found no difference in death rates among diabetic and non-diabetic patients after cardiac surgery. Therefore, it is concluded that diabetes is highly associated with a person's likelihood of death through intervening macro vascular or other diseases. Also, diabetes may not have a significant direct effect on an elderly individual's likelihood of death.. However, a diabetic person is more at risk of encountering other terminal diseases. Diabetes may predispose patients to more severe upper urinary tract infections that is associated with urinary tract infections (Joshi et al., 1999). Diabetes is also associated with foot ulcers. Other infections found in diabetic patients are: invasive otitis externa, a potentially life-threatening infection; Rhinocerebral mucormycosis; and emphysematous, an uncommon, gas-producing, virulent infection of gallbladder (Joshi et al., 1999).

A person with osteoporosis disease is at risk of having skeletal fractures, deformities and pain (Wingate, 1984). Distal radial and femoral neck fractures associated with minimal trauma are probably much more common in patients with osteoporosis than are vertebral fractures. About eighty percent of hip fractures are associated with osteoporosis. Hip fractures are associated with death. Ismail and colleagues (1998) found a modest excess mortality among women with vertebral deformity compared to the one without vertebral deformities (95% CI 1.0, 3.4). In men, they found a non-significant association between vertebral deformities and mortality. Even among women, the excess mortality become non-

existent after adjusting for other health conditions. Musculoskeletal abnormalities lead to a limited joint mobility, and bony deformities that are associated with an increased risk of ulceration (Sumpio, 2000).

Spector and colleagues (1998) found no association between death and Parkinson's disease (PD). But they found a positive and significant relationship between PD and bedsores. With the introduction of levodopa in the therapy of PD, the mortality among people suffering from PD has reduced (Hoehn, 1983). Roos and colleagues (1996) found similar survival curves for patients with PD and the general population. The principal causes of death among patients with PD were heart diseases, lung infections, dementia, pneumonia, and cerebrovascular disease (Morgante, 2000). The most recent data from DATATOP cohort suggest that carefully selected patients with early and "pure" PD without significant co-morbidity have "supernormal" life expectancy (Poewe et al., 1998).

In summary, the medical literature suggests that bowel and bladder incontinence, diabetes, osteoporosis, Parkinson's disease and musculoskeletal disease have very little, if any, direct association with death. But bowel and bladder incontinence, diabetes, osteoporosis, Parkinson's disease and musculoskeletal disease may be associated with a person's likelihood of encountering negative health outcomes other than death.

The variables indicating average number of Medicaid inpatient days, past psychological problems, and past hypertension are included in the equation predicting the percent of Medicaid residents in the nursing home but are excluded from the current negative health outcome equation. The average number of Medicaid inpatient days, past psychological problems, and past hypertension may affect an elderly person's likelihood of entering a nursing home with a given percent of Medicaid residents. However, these variables are not

expected to be risk factors for the current negative health outcomes after controlling for other comorbid health conditions. An increase in the average number of Medicaid inpatient days can be seen as an indicator of higher State Medicaid expenditures. This may force the State to tighten Medicaid eligibility requirements, which reduce an individual's likelihood of entering a nursing home with higher percent Medicaid residents. But such an action on the government's part is not expected to affect an individual's likelihood of encountering either negative health or death outcomes in the nursing home.

Elderly individuals with past psychological problems may not be different than elderly individuals without these problems in terms of their likelihood of encountering negative health outcomes. Comorbid medical conditions of mentally ill patients are misdiagnosed or undiagnosed due to the existence of a fragmented health care system, lack of access to care, and patient inability to clearly appreciate or describe a medical problem (Goldman, 1999). Morgan and Hullin (1982) found elderly mentally ill persons weighed less than healthy elderly persons and they concluded that this difference was not due to malnutrition. But the lower weight may be a marker for a greater need by these individuals for institutional care. Goldman (1999) attributes better nutrition and reduced exposure to physical trauma and certain pathogens for reduced rates of rheumatoid arthritis among hospitalized schizophrenic individuals. Porell and colleagues (1998) found non-significant association between schizophrenia or psychosis and a nursing home resident's incontinence status. Spector and colleagues (1998) found no association between mental retardation or affective disorders and an individual's likelihood of developing bedsores, infections or functional disability. There may exist some relationship between an individual having past psychological problems and the payer mix of the facility in which that individual gets admitted. Individuals entering a

nursing home with past psychological problems are expected to be those who do not need active medical treatment and are not a risk to the health and safety of anybody. Because psychological problems do not require any skilled nursing care, a person with such problems is more likely to enter a nursing home with higher percent Medicaid population. In addition, nursing homes may avoid admitting people with psychological problems like schizophrenia or psychoses as such people are expected to create problems for other residents and nursing home staff as well. A nursing home with higher private paying residents is probably less likely to admit people with psychological problems.

Hypertension is one of the most prevalent health conditions among the elderly (Verbrugge et al., 1995). Fillenbaum and colleagues (2000) found significant comorbidity among hypertension, cardiovascular disease, coronary artery disease, and diabetes. Hypertension was not associated with ADLs, mental status and incontinent (Porell et al., 1998). Spector and colleagues (1998) found no association between hypertension and bedsores or functional disability. However, they did find a negative and significant ($p<0.10$) association between hypertension and infections. Because people with hypertension problems may need more attention and special care, it may affect such persons' likelihood of entering a nursing home with a given percent Medicaid population.

Psychosomatic theories suggest that some diagnoses could be considered as risk factors and others as protective factors regarding the different causes of death (Vlatkovic et al. 1994). In their study, Vlatkovic and colleagues found that dysthymic patients had a decreasing proportion of deaths due to pulmonary diseases and an increasing proportion of deaths due to cardio-vascular disease. In addition, suicide was found to be more frequent in both dysthymic and schizophrenic patients. Among schizophrenic patients, suicide

accounted for 50% of deaths in men and 35% of deaths in women (Mortensen and Juel, 1993). Newman and Bland (1991) found higher than expected rates of mortality from circulatory, respiratory, digestive and genitourinary diseases among schizophrenic patients. According to them, an increased suicide risk may be an indicator of some adverse effects of deinstitutionalization. Mortensen and Juel (1993) found a decrease in mortality from cancer among schizophrenic patients. Porell and colleagues (1998) found schizophrenia and psychosis, after controlling for various comorbid conditions, as having positive and significant relationship with the likelihood of survival of an elderly resident of a nursing home. Therefore, it is concluded that mental illness may improve an institutionalized individual's likelihood of living longer life.

Hypertension was not a significant predictor of 6-year mortality (Fillenbaum et al., 2000). Trenkwalder and colleagues (1999) found no increased risk of death among hypertensives compared to non-hypertensives. Hart and colleagues (2000) found no difference in stroke incidence and mortality in persons suffering from hypertension

Average Medicaid inpatient days per 10 beneficiaries in the county (Market) is a continuous market-level variable. Six dummy variables indicating a sampled individual's health status prior to the sampled nursing home admission are: bowel and bladder incontinence; psychological problems; hypertension; diabetes; musculoskeletal or osteoporosis problems; parkinsonism; and other infections. The past negative outcomes equation includes other past infections. Other past infections may increase the likelihood of past negative outcomes. Because other past infections are not chronic infections, however they may not have any effect on current outcomes or percentage of Medicaid residents. This variable is excluded from all other equations. Similarly, dummy variables indicating past

bowel and bladder incontinence, past diabetes, past musculoskeletal or osteoporosis problems, and past parkinsonism are included in all except the death outcome equation. None of the variables except past bowel and bladder incontinence require skilled care. Therefore, excluding past bowel and bladder problems, all others variables may have a positive relationship with percent Medicaid residents. A dummy variable indicating that an individual had been diagnosed with psychological problems within three months prior to being admitted in the nursing home is included in the percent Medicaid residents and death outcome equations. Past hypertension problems may not affect an individual's likelihood of encountering current negative health outcomes and death. But such individuals may require skilled or special care. Therefore, an individual having hypertension problems is more likely to go into a nursing home with lower percent Medicaid residents.

DESCRIPTIVE STATISTICS

The empirical model regarding nursing home quality of care and access to nursing home care for the Medicaid population is estimated using data on individuals included in the National Long-term Care survey and who were admitted at least once during the period from April 1984 to June 1995. There are 4,433 elderly persons who were admitted at least once during this time period. After merging with OSCAR data, the final sample consisted of 2,750 observations. Approximately twenty-two percent of the individuals encountered at least one of the negative health outcomes measuring quality of care in this study. But 53.9 percent of the sampled individuals had also encountered at least one of the negative health outcomes three months prior to admission (Table 3.4). Sixteen percent of the sample died in

the nursing home during the study time. The average proportion of Medicaid residents in the nursing homes included in this sample is 50.18 percent.

More than 50% of the individuals were admitted after the implementation of OBRA 87 regulation. Less than a quarter (23.6%) of the sample belongs to high demand markets and about one third (32.4%) are from low demand markets (Table 3.4). A majority of the individuals (51.2%) were in nursing homes located in high competition markets. But only 8.2 percent belonged to markets with nursing homes having average occupancy rates equal to or greater than 0.93 and Herfindahl index less than equal to 0.1. The average reimbursement rate is 69.72 dollars per day. On the average, the per day Medicaid reimbursement rate is lower in the low demand markets ($63.33) compare to the high demand markets ($69.54). It seems that rate is comparatively higher in the moderate demand markets. The average number of females over 15 years of age is 3.55 per thousand peope 75 years or older in the markets included in this study. Females are in majority among the 75 and over population in all the markets with an average of 65.01 percent. For every elderly person, there are, on average, approximately 11 people on Medicaid across all markets. This analysis includes 79.5 percent of the nursing homes located in urban areas. The sampled markets have, on average, more average Medicare inpatient days than the average Medicaid inpatient days. Almost two-thirds of the beds, on average, are owned by for-profit nursing homes in the sampled markets. The number of services covered by Medicaid reimbursement rates ranged from none to a maximum of seven, with a mean 4.13.

One third of the sampled nursing homes have non-profit ownership. Average of ADL, Standard, and Residual indices are 10.46, 0.182 and 45.4, respectively. Females represent two-thirds (67.4 %) of the sample. Only 6.8 percent of individuals, in the sample, have

Table 3.4: Descriptive Statistics for Dependent and Independent Variables Used in Models of Any of the Negative Health Outcomes (*N*=2,750)

Variables	Mean	St. Dev.	Min	Max
Dependent Variables				
Any of the negative health outcomes (0,1)	0.218	0.413	0.0	1.0
Death outcome (0,1)	0.160	0.366	0.0	1.0
Endogenous Variables				
Percent Medicaid residents in the nursing home	50.18	30.11	0.0	100.0
Past negative health outcomes (0,1)	0.539	0.499	0.0	1.0
Explanatory Variables				
Policy Variables				
OBRA 1987 (0,1)	0.572	0.495	0.0	1.0
High demand (0,1)	0.236	0.424	0.0	1.0
Low demand (0,1)	0.324	0.468	0.0	1.0
High competition (0,1)	0.512	0.499	0.0	1.0
High competition×high demand (0,1)	0.082	0.275	0.0	1.0
Medicaid reimbursement rate (in dollars)	4.22	22.03	−35.26	89.94
Medicaid reimbursement rate×high demand	4.04	15.50	−32.70	77.50
Medicaid reimbursement rate×low demand	−2.17	8.81	−35.26	52.5
Market Characteristics (County)				
Non-working women over 15 age per thousand aged Over 75	3.55	1.81	0.07	18.8
Female proportion in 75 years and older population	65.01	3.07	50.70	71.01
Medicaid population per elderly	10.79	0.747	6.099	17.16
Urban (0,1)	0.795	0.404	0.0	1.0
Average number of Medicaid inpatient days per 10 Beneficiaries	1.59	2.56	0.0	53.50
Average number of Medicare inpatient days per 10 Beneficiaries	3.21	1.67	0.0	17.93
Proportion of beds owned by for-profit nursing Homes	0.676	0.219	0.0	1.0
Number of services covered by Medicaid rate	4.13	1.68	0.0	7.0
Facility Characteristics				
Non-profit nursing home (0,1)	0.331	0.471	0.0	1.0
Mobility index	10.46	1.62	0.0	18.0
Specialized Care index×10	1.82	2.87	0.0	33.81
Residual index/10	4.54	1.67	0.0	12.14
Individual Characteristics				
Male (0,1)	0.326	0.469	0.0	1.0
Black (0	0.068	0.251	0.0	1.0
Age {(age-70)/10}	11.44	7.85	−6.0	36.0
Past bowel and bladder problems (0,1)	0.054	0.226	0.0	1.0
Past dementia or Alzheimer's disease problem (0,1)	0.171	0.376	0.0	1.0
Past psychological problems (0,1)	0.058	0.234	0.0	1.0
Past heart problems (0	0.714	0.452	0.0	1.0
Past hypertension problems (0,1)	0.340	0.474	0.0	1.0

(Table continues on next page)

Table 3.4: Descriptive Statistics for Dependent and Independent Variables Used in Models of Any of the Negative Health Outcomes (Cont.)

Variables	Mean	St. Dev.	Min	Max
Past cancer problems (0,1)	0.169	0.375	0.0	1.0
Past COPD or respiratory system problems (0,1)	0.303	0.459	0.0	1.0
Past circulatory problems (0,1)	0.073	0.261	0.0	1.0
Past diabetes problems (0,1)	0.196	0.397	0.0	1.0
Past osteoporosis or Musculoskeletal problem (0,1)	0.165	0.371	0.0	1.0
Past parkinson disease problems (0,1)	0.037	0.189	0.0	1.0
Past other infections problems (0,1)	0.152	0.359	0.0	1.0

African- American ethnicity. The average age of the sampled individuals is 81.44 years. The data contain 5.4% individuals who experienced bowel and bladder incontinence three months prior to admission. Seventeen percent of the sample had dementia or Alzheimer's diseases reported before admission. A majority (71.1%) was diagnosed with heart problems prior to their sampled nursing home stay. Thirty four percent of the sample had been diagnosed with hypertension prior to admission. Approximately 17 percent of the sample reported cancer problems before admission. Thirty percent had COPD or respiratory system problems reported in the past. About twenty percent had diabetes. There are 16.5 percent who have been diagnosed for osteoporosis or muscloskeletal disease problem.Individuals with Medicare records showing other infection problems comprised 15.2 percent of the total.

The summary suggests that a majority of the sample had been diagnosed with at least one health problem in the three months prior to admission. Also, more than half of the sample represents the post-OBRA period. To obtain reliable estimates, this analysis uses a system of simultaneous equations controlling for various individual-, facility- and market-level variables. This study, further, controls for individual- and market-level unobserved factors using the discrete factor technique.

CHAPTER FOUR

RESULTS: EFFECTS OF OBRA 87 REGULATION, MARKET COMPETITION, DEMAND LEVELS, AND MEDICAID REIMBURSEMENT RATE ON THE QUALITY OF NURSING HOME CARE AND ACCESSIBILTY TO NURSING HOME CARE FOR THE MEDICAID POPULATION

Econometric analysis suggests that the percentage of Medicaid residents in the nursing home and the past negative outcomes experienced by individuals endogenously affect the negative health outcomes, including death. In addition, the estimated results indicate that common unobserved factors affect the negative health outcomes as well as death. Also, it is evident from the analysis that past negative outcomes influence nursing home selection.

To estimate the effect of OBRA 1987 on the quality of and access to nursing home care, it is necessary to account for any changes in health and nursing home care over time that may affect an individual's health outcomes. Changes in health care or health status are accounted for by including the average number of Medicare and Medicaid inpatient days in the analysis. The intuition is that a reduction in the average number of Medicare or Medicaid inpatient days in a market may suggest that the patients entering hospitals, on average, are less sick. It may take longer time to ascertain the appropriate diagnosis for a sicker person. Once, an appropriate diagnosis is confirmed, a sicker person is expected to take longer time to recover. If the health status of people in a market is poorer, providers in that market may receive more

patients with higher case severity. In such a case, it may take even longer for a sick person to recover. Therefore, the average number of Medicare or Medicaid inpatient days in a market may increase with a drop in the average health status of people in that market. Time trends in the health status of individuals entering nursing homes are accounted for by including variables indicating the individual's health status prior to admission, and the facility-level severity indices. The major trends in nursing home care are thought to essentially arise from changing market demand for nursing home care, and the implementation of OBRA 1987 regulation. These two factors have been accounted for in this analysis. During the period 1984 to 1995, other changes in the nursing home markets are — 1) Short hospital stays as a result of Medicare reimbursing hospitals prospectively. This means that nursing homes may be receiving sicker Medicare residents. This further reinforces the need to account for individual as well as facility-level case mix in their analysis; 2) Growth of managed care in nursing home markets. Managed care in this market may have forced nursing homes to merge to increase their bargaining power, and it may be forcing nursing homes to be efficient; and 3) Improvement in benefits for long-term care alternatives that take care of elderly people with lesser care needs. Thus, nursing homes are expected to receive residents with higher case severity. I am not aware of any other changes that might have taken place in nursing home markets during the period. After accounting for individual- and facility-level case mix, it is expected that there will not be any significant effect of these trends on the quality of and access to nursing home care compared to the effects of OBRA 1987 regulation and changing market demand levels.

This chapter begins by presenting results from the simultaneous-equation model predicting the negative health outcomes within three months prior to admission and ends

with the model predicting death outcome. Results are obtained using full-information maximum likelihood estimation with discrete factor approximation to account for both individual-level and market-level heterogeneity. An attempt is made to compare full-information maximum likelihood (FIML) model results with those obtained through single equation and two-step instrumental variables estimation using generalized estimating equations (GEE) that account for clustering effects. The discussion is focused on FIML results, as this model yields more accurate estimates than single or two-step techniques.

NEGATIVE HEALTH OUTOMES PRIOR TO ADMISSION

A few policy variables seem to affect the probability of the past negative health outcomes (Table 4.1). The likelihood of an individual entering a nursing home with the greater health severity after the implementation of OBRA 87 required minimum quality standards appear to have increased ($p<0.05$). This may be partially due to the earlier discharges by the hospitals as a result of DRG reimbursement system implemented by HCFA before 1990. Increased competition in high demand markets may have forced nursing home providers to admit elderly people in even worse health. The variable indicating high competition in high demand markets has a positive and significant coefficient ($p<0.10$). Increasing the Medicaid reimbursement rate in high demand markets reduces the likelihood of an individual entering a nursing home with the negative health outcomes($p<0.10$). This effect is small. Other policy variables do not have any significant effect in this model.

The GEE and FIML models predicting past negative health differ in that the FIML model accounts for cross-equation correlation from the unobserved individual- and market-level factors. In both the models, OBRA 87 regulation is positively related to nursing home

Table 4.1: Results of Logit Model Predicting the Probability of an Elderly Having Encountered Any of the Negative Health Outcomes in Three Months Prior to Admission in the Nursing Home (N=2,750)

Variables	GEE Model	FIML Model
Policy Variables		
OBRA 1987 (0,1)	0.277*** (0.116)	0.279*** (0.127)
High demand (0,1)	−0.179* (0.135)	−0.167 (0.143)
Low demand (0,1)	−0.022 (0.104)	−0.006 (0.118)
High competition (0,1)	0.019 (0.110)	−0.022 (0.126)
High competition×high demand (0,1)	0.311* (0.243)	0.464** (0.272)
Medicaid reimbursement rate (in dollars)	0.00036 (0.00373)	0.00014 (0.00420)
Medicaid reimbursement rate×high demand	−0.00551 (0.00512)	−0.00967** (0.00560)
Medicaid reimbursement rate×low demand	−0.00298 (0.00610)	−0.00469 (0.00680)
Market Characteristics		
Non-working women over 15 age per thousand aged over 75	0.0183 (0.0258)	0.0037 (0.0281)
Female proportion in 75 years and older population	−0.0017 (0.0165)	0.0161 (0.0162)
Medicaid population per elderly	−0.0099 (0.0633)	−0.0218 (0.0655)
Urban (0,1)	−0.060 (0.130)	0.011 (0.139)
Average number of Medicaid inpatient days per 10 beneficiaries	−0.0025 (0.0179)	0.0034 (0.0182)
Average number of Medicare inpatient days per 10 beneficiaries	−0.0021 (0.0312)	0.0017 (0.0315)
Proportion of beds owned by for-profit nursing homes	−0.129 (0.224)	−0.166 (0.239)
Number of services covered by Medicaid rate	0.0560*** (0.0264)	0.0576** (0.0304)
Facility Characteristics		
Non-profit nursing home (0,1)	−0.1199 (0.0950)	−0.052 (0.108)
Mobility index	0.0201 (0.0287)	0.0259 (0.0325)
Specialized care index×10	−0.0222* (0.0161)	−0.0062 (0.0204)
Other care index/10	0.0525** (0.0295)	0.0648** (0.0335)

Table continues on next page

Table 4.1: Results of Logit Model Predicting the Probability of an Elderly Having Encountered Any of the Negative Health Outcomes in Three Months Prior to Admission in the Nursing Home (Cont.)

Variables	GEE Model	FIML Model
Individual Characteristics		
Male (0,1)	–0.1894*** (0.0909)	–0.218*** (0.100)
Black (0,1)	0.143 (0.167)	0.098 (0.183)
Age {(age–70)/10}	0.01034** (0.00545)	0.01249*** (0.00600)
Past bowl and bladder incontinent problem (0,1)	1.030**** (0.206)	0.975**** (0.230)
Past dementia or alzheimer's disease (0,1)	0.083 (0.113)	0.076 (0.124)
Past psychological problems (0,1)	0.203 (0.183)	0.160 (0.202)
Past heart problems (0,1)	0.4047**** (0.0939)	0.417**** (0.104)
Past hypertension problems (0,1)	–0.1106 (0.0906)	–0.090 (0.100)
Past cancer problems (0,1)	0.279*** (0.112)	0.354**** (0.124)
Past COPD or respiratory system problems (0,1)	0.4106**** (0.0926)	0.395**** (0.103)
Past circulatory problems (0,1)	0.141 (0.161)	0.145 (0.175)
Past diabetes problems (0,1)	0.212*** (0.107)	0.194** (0.115)
Past osteoporosis or musculoskeletal problems (0,1)	0.034 (0.113)	0.089 (0.124)
Past parkinson disease problems (0,1)	0.551*** (0.227)	0.532*** (0.251)
Past other infections (0,1)	1.629**** (0.141)	1.620**** (0.153)
Constant	–1.12 (1.14)	–2.315*** (0.999)
Heterogeneity Terms (FIML Model Only)		
Market—level		0.223* 0.159)
Individual—level		–0.246* (0.183)

1. FIML stands for full information Maximum likelihood model using discrete factor modelling techniques.
2. GEE stands for generalized equations estimating models controlling for market level clustering effect.
3. Errors are shown in parenthesis.

**** $p<0.01$ *** $p<0.05$ ** $p<0.10$ * $p<0.20$

entering individuals' negative health outcomes within three months prior to admission. Both high competition and the Medicaid reimbursement rate have similar relationships to the past negative outcomes in both models. But the significance level and the level of effect are greater in the FIML model.

Effects of Market Characteristics

Except for the number of services covered by Medicaid rate, all other market variables are statistically insignificant predictors of past negative health outcomes in both the FIML and GEE models. With the number of services covered by the Medicaid rate, the probability of an individual entering a nursing home with negative health outcomes prior to admission increases. This relationship is statistically significant in both the FIML and GEE models with $p<0.10$ and $p<0.05$ respectively. As stated earlier, the Medicaid population becomes more profitable with an increase in the number of services covered under the Medicaid rate, perhaps prompting nursing home providers to take the risk of admitting prospective clients with higher severity levels too.

Effects of Facility Characteristics

The only facility-level variable that has a statistically significant relationship with the negative health outcomes of an individual entering nursing home is the other care index. This index accounts for the proportion of residents with indwelling catheters, bowel and bladder incontinence, and receiving skin care needs. Both models show similar relationship for this variable ($p<0.10$).

Effects of Individual Characteristics

As expected, several individual characteristics emerge as significant predictors of an individual entering a nursing home with negative health outcomes. Males appear to have a lower likelihood of having encountered the negative health outcomes in the past ($p<0.05$). There seems to be no statistically significant difference among nursing home entrants by race. Older elderly people going to nursing home appear to have a higher probability of experiencing the negative health outcomes prior to admission ($p<0.05$). Individuals diagnosed for the bowel or bladder incontinence, heart problems, cancer, COPD, respiratory system problems or other infections are more likely to have encountered negative health outcomes before admission ($p<0.01$). Past diagnosis of diabetes or parkinsonism strongly predicts the negative health outcomes ($p<0.05$). In the FIML model, past diagnosis of diabetes is significant at a lower level ($p<0.10$), while in the GEE model it is significant at ($p<0.05$). A nursing home entrant's past diagnosis of dementia, Alzheimer's disease, psychological problems, hypertension, circulatory problems, osteoporosis or musculoskeletal problems appear to have no relationship with that person's likelihood of experiencing past negative health outcomes.

Unobserved Heterogeneity

Coefficient estimates for the individual- and market-level heterogeneity terms are negative and positive respectively. Both have significant relationship at $p<0.20$ significance level. These results suggest that market-level unobserved factors such as competition from other formal elderly care settings may force nursing homes to accept new prospects with higher severity. Similarly, there are some individual-level factors such as overall health status that reduce the overall probability of an individual entering nursing home with past

negative health outcomes. The correlation between each of these heterogeneity terms and the past negative outcomes suggests that the results from the GEE model are expected to be biased.

PERCENT MEDICAID RESIDENTS IN THE FACILITY (MEDICAID POPULATION'S ACCESS TO NURSING HOME CARE)

The model estimating the percent Medicaid residents in the nursing home fails to find a statistically significant effect of an individual's past negative health outcomes on the percent Medicaid residents in the facility after controlling for the endogenous past negative health outcomes (Table 4.2). This section focuses on estimates obtained from the FIML model that includes a linear equation of the percent Medicaid population in the nursing home, estimated jointly in the system of equations. Estimates from the single and two-step GEE models are also presented for comparison. In general, the coefficients produced by the FIML model have the smallest standard errors followed by the single equation model. The two-step GEE model yielded coefficients with the largest standard errors.

Effect of Endogenous Past Negative Health Outcomes

The FIML and two-step models failed to yield significant relationship between an individual's past negative health outcomes and the percent Medicaid residents in the facility. On the other hand, the single equation GEE model produces a positive and statistically significant effect of the negative health outcomes in the equation.

Effects of Policy Variables

Among all three models, the FIML model produces not only the smallest coefficients with the smallest standard errors but it also yields more variables with statistically significant

Table 4.2: Results of Linear Regression Model Predicting Percent Medicaid Residents in the Nursing Home (N=2,750)

Variables	GEE Model (Assuming Exogeneity)	GEE Model (Controlling Endogeneity)	FIML Model (Controlling Endogeneity)
Past negative health outcome (0,1)	1.798*** (0.910)	−0.32 (3.80)	0.118 (0.260)
Policy Variables			
OBRA 1987 (0,1)	−3.24*** (1.33)	−3.10*** (1.35)	−0.930**** (0.342)
High demand (0,1)	8.76**** (1.63)	8.69**** (1.64)	1.309**** (0.444)
Low demand (0,1)	−4.52**** (1.27)	−4.53**** (1.28)	−1.457**** (0.323)
High competition (0,1)	−1.06 (1.52)	−1.08 (1.52)	0.496* (0.335)
High competition×high demand (0,1)	3.85* (3.02)	4.03* (3.03)	3.653**** (0.946)
Medicaid reimbursement rate (in dollars)	0.1877**** (0.0454)	0.1890**** (0.0454)	0.0355**** (0.0122)
Medicaid reimbursement rate×high demand	−0.1511*** (0.0593)	−0.1542**** (0.0595)	−0.0702**** (0.0180)
Medicaid reimbursement rate×low demand	0.0390 (0.0708)	0.0371 (0.0709)	−0.0283** (0.0165)
Market Characteristics			
Non-working women over 15 age per thousand aged over 75	0.942**** (0.342)	0.955**** (0.343)	0.0494 (0.0870)
Female proportion in 75 years and older population	0.412** (0.230)	0.418** (0.230)	0.0949**** (0.0329)
Medicaid population per elderly	0.879 (0.836)	0.889 (0.837)	0.136 (0.151)
Urban (0,1)	−5.14**** (1.70)	−5.14**** (1.70)	−0.647** (0.385)
Average number of Medicaid inpatient days per 10 beneficiaries	0.212 (0.230)	0.213 (0.230)	−0.0109 (0.0438)
Average number of Medicare inpatient days per 10 beneficiaries	−1.098**** (0.412)	−1.114**** (0.412)	0.1201* (0.0746)
Proportion of beds owned by for-profit nursing homes	−0.77 (2.92)	−0.78 (2.92)	1.604*** (0.752)
Number of services covered by Medicaid rate	0.224 (0.324)	0.249 (0.328)	0.5378**** (0.0904)
Facility Characteristics			
Non-profit nursing home (0,1)	−12.90**** (1.06)	−12.94**** (1.07)	−0.968**** (0.264)
Mobility index	0.150 (0.318)	0.156 (0.319)	0.1205* (0.0779)
Specialized care index×10	−3.298**** (0.180)	−3.313**** (0.182)	−0.0959*** (0.0390)
Other care index/10	3.415**** (0.325)	3.448**** (0.331)	−0.0135 (0.0806)

Table continues on next page

Table 4.2: Results of Linear Regression Model Predicting Percent Medicaid Residents in the Nursing Home (Cont.)

Variables	GEE Model (Assuming Exogeneity)	GEE Model (Controlling Endogeneity)	FIML Model (Controlling Endogeneity)
Individual Characteristics			
Male (0,1)	−0.219 (0.987)	−0.29 (1.00)	−0.119 (0.273)
Black (0,1)	10.79**** (1.83)	10.88**** (1.83)	1.587**** (0.492)
Age {(age−70)/10}	0.0661 (0.0593)	0.0704 (0.0598)	−0.0132 0.0167
Past bowel and bladder incontinent problem (0,1)	−1.05 (1.98)	−0.56 (2.15)	−0.280 (0.706)
Past dementia or alzheimer's disease (0,1)	3.74**** (1.22)	3.79**** 1.22	0.390 0.36
Past psychological problems (0,1)	3.09* (1.94)	3.23** (1.95)	1.406** (0.767)
Past heart problems (0,1)	2.62*** (1.02)	2.81**** (1.08)	0.532*** (0.270)
Past hypertension problems (0,1)	−1.781** (0.981)	−1.838** (0.989)	−1.300**** (0.267)
Past cancer problems (0,1)	−1.70* (1.21)	−1.57 (1.24)	−0.122 (0.289)
Past COPD or respiratory problems (0,1)	0.347 (0.996)	0.55 (1.06)	−0.334 (0.276)
Past circulatory problems (0,1)	−2.90** (1.70)	−2.79* (1.72)	−0.461 (0.437)
Past diabetes problems (0,1)	0.50 (1.15)	0.61 (1.17)	0.177 (0.331)
Past osteoporosis or musculoskeletal problems (0,1)	−2.28** (1.22)	−2.22** (1.23)	0.032 (0.334)
Past parkinson disease problems (0,1)	4.83*** (2.38)	5.08*** (2.43)	0.825 (0.753)
Constant	8.1 (15.5)	8.2 (15.5)	80.08**** (1.31)
Heterogeneity Terms (FIML Model Only)			
Market—level			5.429**** (0.443)
Individual—level			−90.122**** (0.764)
Scale parameter (GEE model only)	560.17	561.05	
Sigma (FIML model only)			2.9585 (0.0655)****

4. FIML stands for full information Maximum likelihood model using discrete factor modelling techniques.
5. GEE stands for generalized equations estimating models controlling for market level clustering effect.
6. Errors are shown in parenthesis.

**** *p*<0.01   *** *p*<0.05   ** *p*<0.10   * *p*<0.20

coefficients. All three models show the negative effect of OBRA 87 regulation on the Medicaid population's access to nursing home care. This relationship between the percent Medicaid residents and OBRA 87 regulation negates the proposed hypothesis stating that the access increased after the implementation of OBRA 87 ($p<0.01$).

As expected, an individual is more likely to enter a nursing home with higher percent Medicaid residents in a high demand market ($p<0.01$). Access to nursing home care decreases in low demand markets ($p<0.01$). The sign of the high competition dummy variable is positive but weakly significant in the FIML model, while in both the GEE models the sign is negative and insignificant. The proposed hypothesis that the percent Medicaid residents in a nursing home decreases with competition irrespective of the market demand level is contradicted by the FIML model. The results suggest that competition improves access to nursing homes for the Medicaid population in low ($p<0.15$) as well as high demand markets ($p<0.01$). The results also suggest that nursing home care becomes more accessible to the Medicaid population with an increase in competition in the high than the low demand markets ($p<0.01$). The results of the two GEE models show no effect of competition on the access to nursing home care ($p<0.10$).

In the moderate demand markets, the access to nursing home care for the Medicaid population increases with an increase in the Medicaid reimbursement rate ($p<0.01$). There is a differential effect of the Medicaid reimbursement rate on the market demand in that the Medicaid reimbursement rate decreases access in low demand markets compared to moderate demand markets but this effect is more pronounced in high demand markets. The proposed hypothesis that forecasts that the percent Medicaid residents in excess demand markets increases with an increase in the Medicaid reimbursement rate is negated in the FIML model.

On the contrary, the results indicate a decrease in access to the Medicaid population in excess demand market as the Medicaid reimbursement rate goes up ($p<0.02$). On the other hand, two GEE models support the hypothesis that an increase in the Medicaid rate leads to higher access to nursing home care for the Medicaid population in moderate and high demand markets. But the results of these two models do not support the hypothesis that an increase in the Medicaid rate leads to a decrease in access to nursing home care in excess capacity markets.

Effects of Market Characteristics

Several market characteristics are significant predictors of the percent Medicaid residents in the facility. A higher female proportion among the elderly population in the market increases the likelihood of a nursing home having a higher percent Medicaid population ($p<0.01$). An individual living in an urban area is more likely to go to a nursing home with a lower percent Medicaid residents. This relationship is statistically significant at lower significance level in the FIML model ($p<0.10$) compare to the two GEE models ($p<0.01$). The average number of Medicare inpatient days is positively related to the percent Medicaid residents in the FIML model ($p<0.20$), while it is negatively related in the two GEE models ($p<0.01$). Proportion of beds owned by the for-profit nursing homes and the number of services covered by the Medicaid rate have statistically significant coefficients with positive signs in the FIML model.

Effects of Facility Characteristics

All three models predict non-profit nursing homes to have lower percent Medicaid residents ($p<0.01$) but this coefficient in FIML models is relatively very small. The mobility index coefficient is positive in all three models but is significant only in the FIML model

($p<0.20$). The specialized care index is negatively and significantly related to the percent Medicaid population in all three models ($p<0.05$). The other care index has significant and positive coefficients in the two GEE models.

Effects of Individual Characteristics

A few individual characteristics are significant predictors of the percent Medicaid residents in the facility. A black elderly person is more likely than a white elderly person to enter a nursing home with higher percent Medicaid residents ($p<0.01$). An individual diagnosed in the past with dementia or Alzheimer's diseases or osteoporosis or musculoskeletal has a positive relationship with the percent Medicaid residents in the facility. But these relationships are not significant in the FIML model. An individual with past psychological problems is more likely to enter a facility with higher percent Medicaid residents ($p<0.10$). A similar relationship is detected for an individual with past heart problems ($p<0.05$). On the other hand, an individual with hypertension problems is more likely to enter a nursing home with lower percent Medicaid residents ($p<0.01$).

Unobserved Heterogeneity

Coefficient estimates for the market- and individual-level heterogeneity terms are positive and negative respectively in the percent Medicaid resident equation ($p<0.01$). The results suggests that an increase in competition from alternate formal settings force nursing homes to relax Medicaid population acceptability and that unobserved individual's overall health status may allow an individual to make more informed decisions. This leads an individual to select a nursing home with lower percent Medicaid residents.

NEGATIVE HEALTH OUTCOMES WHILE IN THE NURSING HOME

Effects of Endogenous Variables

The results of the FIML model show a positive and statistically significant effect of the percent Medicaid residents on the current negative health outcomes of an individual staying in that facility ($p<0.05$). The two-step GEE model does not detect any significance (Table 4.3). The GEE model that assumes all the right-hand-side variables to be exogenous has a similar but significant coefficient ($p<0.01$). All three models predict an increase in the likelihood of negative health outcomes for an individual entering a nursing home with the past negative health outcomes ($p<0.01$). The FIML model coefficient for this variable has a value that falls between the values for the same coefficient in the two GEE models.

Effects of Policy Variables

Results from the FIML model provide no indication that OBRA 87 required increases in minimum quality standards raised the risk of the current negative health outcomes, after controlling for the endogeneity of the percent Medicaid residents in the facility and the past negative health outcomes. In other words, this regulation has no effect on the quality of nursing home care as measured by the selected health outcomes. The results also fail to detect the effect of competition on the negative health outcomes. Therefore, the proposed hypotheses that competition increases quality of care in the high as well as the low demand markets are not supported by this model.

Similarly, the three models show no evidence that the Medicaid reimbursement reduces the risk of an individual encountering the current negative health outcomes in the moderate as well as low demand markets. Only the FIML model, as hypothesized, detects that higher Medicaid reimbursement increases the risk of current negative health outcomes in high

Table 4.3: Results of Logit Model Predicting the Probability of Any of the Current Negative Health Outcomes (*N*=2,750)

Variables	GEE Model (Assuming Exogeneity)	GEE Model (Controlling Endogeneity)	FIML Model (Controlling Endogeneity)
Percent Medicaid residents in the nursing home	0.00716**** (0.00214)	0.0231 (0.0404)	0.0711*** (0.0281)
Past negative health outcome (0,1)	0.643**** (0.104)	0.814*** (0.398)	0.725**** (0.115)
Policy Variables			
OBRA 1987 (0,1)	0.021 (0.142)	0.071 (0.199)	0.108 (0.158)
High demand (0,1)	0.004 (0.170)	−0.137 (0.395)	−0.103 (0.177)
Low demand (0,1)	−0.070 (0.133)	0.001 (0.230)	0.076 (0.151)
High competition (0,1)	0.102 (0.147)	0.107 (0.152)	−0.038 (0.157)
High competition×high demand (0,1)	−0.011 (0.295)	−0.073 (0.335)	−0.118 (0.328)
Medicaid reimbursement rate (in dollars)	−0.00269 (0.00458)	−0.00554 (0.00884)	−0.00659 (0.00520)
Medicaid reimbursement rate×high demand	0.00829* (0.00612)	0.01086 (0.00858)	0.01462*** (0.00680)
Medicaid reimbursement rate×low demand	0.00221 (0.00775)	0.00166 (0.00780)	0.00688 (0.00830)
Market Characteristics			
Non-working women over 15 age per thousand aged over 75	−0.0469* (0.0338)	−0.0629 (0.0515)	−0.0529* (0.0346)
Female proportion in 75 years and older population	0.0653**** (0.0226)	0.0589*** (0.0278)	0.0798**** (0.0220)
Medicaid population per elderly	−0.2543**** (0.0878)	−0.2642**** (0.0952)	−0.2386**** (0.0860)
Urban (0,1)	−0.270* (0.166)	−0.171 (0.273)	−0.247* (0.169)
Average number of Medicare inpatient days per 10 beneficiaries	0.0248 (0.0383)	0.0416 (0.0552)	0.0215 (0.0362)
Proportion of beds owned by for-profit nursing homes	0.061 (0.277)	0.112 (0.286)	−0.094 (0.286)
Number of services covered by Medicaid rate	−0.0702*** (0.0334)	−0.0772*** (0.0347)	−0.1025**** (0.0397)
Facility Characteristics			
Non-profit nursing home (0,1)	−0.416**** (0.125)	−0.191 (0.537)	−0.372**** (0.138)
Mobility index	−0.0185 (0.0371)	−0.0207 (0.0369)	−0.0202 (0.0416)
Specialized care index×10	−0.0133 (0.0238)	0.038 (0.137)	−0.0158 (0.0295)
Other care index/10	0.0499* (0.0368)	−0.015 (0.144)	0.0504 (0.0403)

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Table 4.3: Results of Logit Model Predicting the Probability of Any of the Current Negative Health Outcomes (Cont.)

Variables	GEE Model (Assuming Exogeneity)	GEE Model (Controlling Endogeneity)	FIML Model (Controlling Endogeneity)
Individual Characteristics			
Male (0,1)	0.056 (0.110)	0.069 (0.110)	0.089 (0.121)
Black (0,1)	0.275* (0.184)	0.098 (0.462)	0.112 (0.208)
Age {(age–70)/10}	0.00439 (0.00659)	0.00242 (0.00726)	0.00609 (0.00720)
Past bowl and bladder incontinent problem (0,1)	0.191 (0.204)	0.170 (0.222)	0.242 (0.228)
Past dementia or alzheimer's disease (0,1)	0.377**** (0.125)	0.294* (0.208)	0.291*** (0.138)
Past heart problems (0,1)	0.138 (0.116)	0.077 (0.154)	0.149 (0.131)
Past cancer problems (0,1)	–0.181* (0.141)	–0.168 (0.156)	–0.098 (0.153)
Past COPD or respiratory problems (0,1)	0.102 (0.109)	0.071 (0.116)	0.098 (0.121)
Past circulatory problems (0,1)	0.122 (0.182)	0.148 (0.216)	0.041 (0.200)
Past diabetes problems (0,1)	0.397**** (0.120)	0.373**** (0.122)	0.386**** (0.131)
Past osteoporosis or musculoskeletal problems (0,1)	0.239** (0.133)	0.275** (0.162)	0.240** (0.145)
Past parkinson disease problems (0,1)	–0.046 (0.260)	-0.171 (0.344)	0.042 (0.282)
Constant	–3.42*** (1.52)	–3.62*** (1.58)	–10.07**** (2.62)
Heterogeneity Terms (FIML Model Only)			
Market—level			–1.114**** (0.2734)
Individual—level			5.810**** (2.563)

7. FIML stands for full information Maximum likelihood model using discrete factor modelling technique.
8. GEE stands for generalized equations estimating models controlling for market level clustering effect.
9. Errors are shown in parenthesis.

**** $p<0.01$ *** $p<0.05$ ** $p<0.10$ * $p<0.20$

demand markets ($p<0.05$). In addition, it also suggests that the quality goes down with the reimbursement rate in high demand markets compared to moderate demand markets ($p<0.05$).

Effects of Market Characteristics

The results indicate that an increase in competition from the potential informal care providers lowers the risk of experiencing negative health outcomes. Measures of non-working women and Medicaid population per elderly person in the county are used as proxies for the potential informal care providers. With an increase in the proportion of non-working women per elderly person, the probability of negative health outcomes decreases ($p<0.15$). This coefficient is not statistically significant in the two-step GEE model. The Medicaid population per elderly person has a negative and statistically significant effect on the negative health outcomes in all three models ($p<0.01$). An increase in the proportion of females in the elderly population raises the probability of an elderly person encountering a negative health outcome while staying in a nursing home in that market ($p<0.01$).

All three models indicate that an individual in a nursing home located in an urban area is less likely to experience negative health outcomes. This relationship is significant in the FIML and single step GEE models ($p<0.15$). An increase in the number of services covered by the Medicaid reimbursement rate reduces the probability of negative health outcomes in all three models. But this effect is larger and more significant in the FIML model.

Effects of Facility Characteristics

Non-profit ownership status has a negative effect on the probability of an elderly person experiencing any negative health outcomes. This effect is statistically significant in the

FIML and single step GEE models only ($p<0.01$). None of the variables indicating the facility-level severity of the residents had an effect on the negative health outcomes.

Effects of Individual Characteristics

Only three individual characteristics have statistically significant effects on an individual's likelihood of experiencing the negative health outcomes in the nursing home. Past dementia and Alzheimer's disease diagnosis leads to a higher likelihood of an individual's risk of encountering the current negative health outcomes ($p<0.05$). This result is significant at significance level 0.20 in the two-step GEE model. An individual with past diabetes problem is more likely to have the negative health outcomes ($p<0.01$). Osteoporosis or musculoskeletal disease increases the risk of the negative outcomes ($p<0.10$).

Unobserved Heterogeneity

Market heterogeneity negatively affects an elderly individual's likelihood of encountering any negative health outcome ($p<0.01$). These results are consistent with the hypothesis that unobserved market competition has a positive effect on the quality of nursing home care. But these results do not support the hypothesis that an individual's unobserved overall health status reduces that individual's probability of encountering any negative health outcomes ($p<0.05$). It may be due to the fact that the sudden health shock that causes an individual to enter a nursing home enhances that individual's probability of having any negative health outcomes by reducing that individual's mobility.

DEATH OUTCOME

Effects of Endogenous Variables

Results from the FIML model (Table 4.4) suggest that the level of payer mix in the facility has no significant effect on the risk of an elderly person dying in that nursing home, even at a significance level of 0.15. The two GEE models show an opposite effect but it is significant only in the two-step model ($p<0.10$). The single-equation GEE and the FIML models indicate that the past negative health outcomes increase the risk of death in the nursing home ($p<0.01$).

Effects of Policy Variables

The FIML model estimates show that the OBRA 87 required increases in the minimum quality standards improved the quality of nursing home care. The OBRA 87 dummy variable has a negative and statistically significant coefficient. This result negates the study hypothesis that the OBRA 87 required minimum quality standards reduce the quality of nursing home care. The two-step GEE model does not show a statistically significant relationship for this variable. Neither the FIML nor the single-step GEE models detect any effect of high demand on the risk of death. The two-step GEE model indicates that high demand reduces the likelihood of death ($p<0.10$). Both the single-step GEE and the FIML models suggest a reduction in the risk of death in the low demand markets ($p<0.01$). The two-step model fails to detect this relationship.

Competition appears to have no significant effect on the risk of death. Also, it has no statistically significant differential effect by market demand levels. Estimates from the FIML model suggest that the Medicaid rate increases the probability of death in moderate demand markets ($p<0.10$). But the rate has no differential effect between the moderate and high

Table 4.4: Results of Logit Model Predicting Death Outcome During Nursing Home Stay Within the Study Period (*N*=2,750)

Variables	GEE Model (Assuming Exogeneity)	GEE Model (Controlling Endogeneity)	FIML Model (Controlling Endogeneity)
Percent Medicaid residents in the nursing home	0.00372* (0.00241)	0.0619** (0.0342)	−0.0209* (0.0150)
Past negative health outcome (0,1)	0.542**** (0.116)	0.500 (0.416)	0.543**** (0.127)
Policy Variables			
OBRA 1987 (0,1)	−0.413**** (0.160)	−0.186 (0.207)	−0.606**** (0.173)
High demand (0,1)	−0.094 (0.181)	−0.617** (0.352)	−0.069 (0.187)
Low demand (0,1)	−0.415**** (0.159)	−0.157 (0.221)	−0.500**** (0.174)
High competition (0,1)	0.057 (0.160)	0.108 (0.164)	0.017 (0.174)
High competition×high demand (0,1)	−0.213 (0.343)	−0.422 (0.370)	−0.138 (0.377)
Medicaid reimbursement rate (in dollars)	0.00513 (0.00509)	−0.00624 (0.00838)	0.00952** (0.00550)
Medicaid reimbursement rate×high demand	0.00026 (0.00682)	0.00935 (0.00854)	−0.00237 (0.00730)
Medicaid reimbursement rate×low demand	−0.01727** (0.00919)	−0.01839*** (0.00919)	−0.01408* (0.01000)
Market Characteristics			
Non-working women over 15 age per thousand aged over 75	0.1068**** (0.0343)	0.0518 (0.0472)	0.1108**** (0.0352)
Female proportion in 75 years and older population	−0.0429** (0.0228)	−0.0635*** (0.0263)	−0.0345* (0.0219)
Medicaid population per elderly	0.1573** (0.0887)	0.1003 (0.0939)	0.1251* (0.0880)
Urban (0,1)	−0.231* (0.177)	0.077 (0.254)	−0.269* (0.179)
Average number of Medicare inpatient days per 10 beneficiaries	−0.0205 (0.0426)	0.0304 (0.0526)	-0.0202 (0.0402)
Proportion of beds owned by for-profit nursing homes	−0.822**** (0.290)	−0.680*** (0.297)	−0.797**** (0.296)
Number of services covered by Medicaid rate	−0.0897*** (0.0360)	−0.1004**** (0.0371)	−0.0799*** (0.0404)
Facility Characteristics			
Non-profit nursing home (0,1)	−0.054 (0.135)	0.707* (0.464)	−0.167 (0.147)
Mobility index	0.0089 (0.0402)	−0.0029 (0.0402)	−0.0233 (0.0450)
Specialized care index×10	0.0060 (0.0250)	0.201** (0.116)	0.0212 (0.0298)
Other care index/10	0.0538* (0.0420)	−0.149 (0.124)	0.0437 (0.0464)

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Table 4.4: Results of Logit Model Predicting Death Outcome During Nursing Home Stay Within the Study Period (Cont.)

Variables	GEE Model (Assuming Exogeneity)	GEE Model (Controlling Endogeneity)	FIML Model (Controlling Endogeneity)
Individual Characteristics			
Male (0,1)	0.444**** (0.118)	0.440**** (0.118)	0.465**** (0.128)
Black (0,1)	–0.196 (0.234)	–0.783** (0.421)	–0.048 (0.258)
Age {(age–70)/10}	0.0247**** (0.0074)	0.0197*** (0.0077)	0.0289**** (0.0080)
Past dementia or alzheimer's disease (0,1)	–0.035 (0.154)	–0.281* (0.207)	0.013 (0.169)
Past psychological problems (0	–0.356* (0.262)	–0.557** (0.288)	–0.337 (0.293)
Past heart problems (0,1)	0.272*** (0.131)	0.123 (0.159)	0.242** (0.144)
Past cancer problems (0,1)	1.304**** (0.130)	1.384**** (0.144)	1.272**** (0.141)
Past COPD or respiratory problems (0,1)	0.098 (0.123)	0.057 (0.129)	0.065 (0.135)
Past circulatory problems (0,1)	0.224 (0.204)	0.394** (0.229)	0.336* (0.211)
Constant	–1.35 (1.58)	–1.95 (1.62)	1.18 (1.33)
Heterogeneity Terms (FIML Model Only)			
Market—level			–0.096 (0.228)
Individual—level			–2.07* (1.33)

10. FIML stands for full information Maximum likelihood model using discrete factor modelling techniques.
11. GEE stands for generalized equations estimating models controlling for market level clustering effect.
12. Errors are shown in parenthesis.

**** $p<0.01$ *** $p<0.05$ ** $p<0.10$ * $p<0.20$

demand markets. On the other hand, all the models detect a reduced risk of death in low compared to moderate demand markets ($p<0.15$). Overall, there is no effect of the Medicaid rate on the death outcome in low demand markets ($p<0.10$). A Wald test weakly supports the study hypothesis that an increase in the Medicaid rate raises the risk of death in high demand markets ($p<0.25$).

Effects of Market Characteristics

An increase in the proportion of non-working women per elderly individual seems to raise the risk of death ($p<0.01$). As the Medicaid population per elderly person increases, the probability of death also rises ($p<0.20$). The proportion of females in the elderly population is negatively related to the probability of death in the nursing home. This relation is weakest in the FIML model ($p<0.20$). The urbanity of the nursing home market reduces the probability of death ($p<0.20$). An increase in for-profit beds appears to lower the risk of death ($p<0.01$). This result negates the general belief that increased dominance of for-profit nursing homes affects the quality of care negatively. The probability of death declines with an increase in the number of services covered by the Medicaid rate ($p<0.01$).

Effects of Facility Characteristics

Non-profit ownership status seems to have no significant effect on the death at traditional significance level in any of the three models. The two-step GEE model shows an increase in the probability of death as the specialized care index rises ($p<0.10$).

Effects of Individual Characteristics

All three models predict that a male elderly person has a higher probability of dying in the nursing home ($p<0.01$). Age has a positive effect on the death outcome ($p<0.01$). The single-step GEE and FIML models detect a positive effect of an individual's past diagnosis of

heart problems on death ($p<0.10$). Two-step GEE finds this effect statistically non-existing. Past cancer problems significantly increase the risk of an elderly nursing home resident's death ($p<0.01$).

Unobserved Heterogeneity

Market heterogeneity has no significant effect on the death outcome of an elderly person. This suggests that unobserved competition has no statistically significant effect on the likelihood of an individual's death. Individual heterogeneity has a negative sign but is significant at 0.20 significance level only. Therefore, the hypothesis that unobserved overall health status of an individual reduces the probability of death in the nursing home is weakly supported.

SUMMARY

This analysis confirms that more elderly people with health problems are entering nursing homes after the implementation of OBRA 87 regulation. Also, this regulation improved the longevity of nursing home residents and reduced the Medicaid population's access to nursing home care. Therefore, the results contradict the proposed hypotheses that OBRA 87 regulation reduced the quality of and improved access to nursing home care for the Medicaid population. The full-information method using discrete approximation, in general, appears to produce better results in terms of lower standard errors.

The analysis finds no support for the hypothesis that competition improves the quality of nursing home care measured by negative outcomes as well as death, if competition is measured among nursing homes only. But the potential competition from informal care providers has a positive effect on the quality of nursing home care. The findings suggest that

competition has no differential effect in high vs. low demand markets. The variables indicating the market demand levels also represent market competitiveness. The results indicate that the death outcome is less likely in low demand (high competition) markets. The Medicaid population's access to nursing home care declines with a decrease in demand (high competition). On the other hand, competition among nursing homes increases access, especially in high demand markets.

The results support the hypothesis that the quality of care deteriorates in high demand markets. But the analysis does not support that hypothesis that the quality of care in low demand markets increases with an increase in the Medicaid reimbursement rate. Also, the hypothesis that the Medicaid population's access to care declines in low demand markets with an increase in the Medicaid reimbursement rate is not supported by the analysis. On the other hand, the results contradict the hypothesis that access improves with an increase in the Medicaid rates in the markets facing excess demand.

CHAPTER FIVE

QUALITY OF NURSING HOME CARE AND THE MEDICAID POPULATION'S ACCESS TO CARE: SIMULATED POLICY SHIFTS

The results of the full-information maximum likelihood (FIML) models discussed in Chapter Four are used to simulate the effects of various policy decisions and market conditions on the quality of and access to nursing home care for the Medicaid population. Simulations focus only on those explanatory variables that are found to be statistically significant predictors of the quality and access measures used in the analysis.

Four sets of simulations are presented in this chapter. The first set uses estimates from the past negative health outcomes model to simulate the effects of OBRA 1987 regulation on negative health outcomes within three months prior to the nursing home admission. In the second set, estimates from the percent Medicaid model are used to simulate the effects of OBRA 1987 regulation, market demand levels, competition, and the Medicaid rate on the percent Medicaid residents in the facility. In addition, the differential effects of the competition and Medicaid rate in different demand levels on the percent Medicaid residents in the facility are also simulated. In the third set, simulations are performed using estimates from the death outcome model to examine the effects of past negative outcomes, percent Medicaid residents, OBRA 1987 regulation, market demand levels and Medicaid reimbursement rate on the probability of death. Finally, estimates from the current negative outcomes model are used to simulate the effects of the percent Medicaid residents in the

facility, past negative outcomes, and Medicaid rate on the probability of the current negative outcomes.

To conduct these simulations, estimates from the FIML model are used to calculate predicted values for each observation and each shift considered here, then the predicted values are averaged across all observations. The marginal effect of any factor at a given point can be approximated by the difference of the estimates between two points under consideration. The effects of factors with interaction terms are simulated either by changing the main factor under consideration or changing the main factor while alternately setting the interacting dummy variable to zero or one. First, the predicted values obtained for each observation are made conditional upon each combination of support points for two heterogeneity terms. Then, these individual conditional predictions are summed up to obtain unconditional estimates. The predicted values for each observation are calculated using the following formula:

$$E(Y_i) = \sum_{\mu}\sum_{\lambda} Y_i(\mu_j, \lambda_k) \times p_{\mu_j} \times p_{\lambda_k}$$

Where μ_j and λ_k are j_{th} and k_{th} support points of individual (μ) heterogeneity and market (λ) heterogeneity terms. The two p's with corresponding subscripts represent the probabilities of respective heterogeneity support points.

Simulations are also conducted for models estimating current negative health outcomes, death and the percent Medicaid residents in the facility.

PAST NEGATIVE HEALTH OUTCOMES

Simulations based on estimates from the FIML model of negative health outcomes prior to admission provide indirect evidence about how the health severity of nursing home entrants changed after the implementation of OBRA 1987 regulation. This change may also

be attributed to other changes in government policies or market factors. If the past negative health outcomes can be assumed to proxy the average health status of an elderly person entering a nursing home, then estimates from this model can provide evidence that supports the hypothesis that elderly individuals entering nursing homes after OBRA 87 regulation require higher levels of care than had been the case before this regulation.

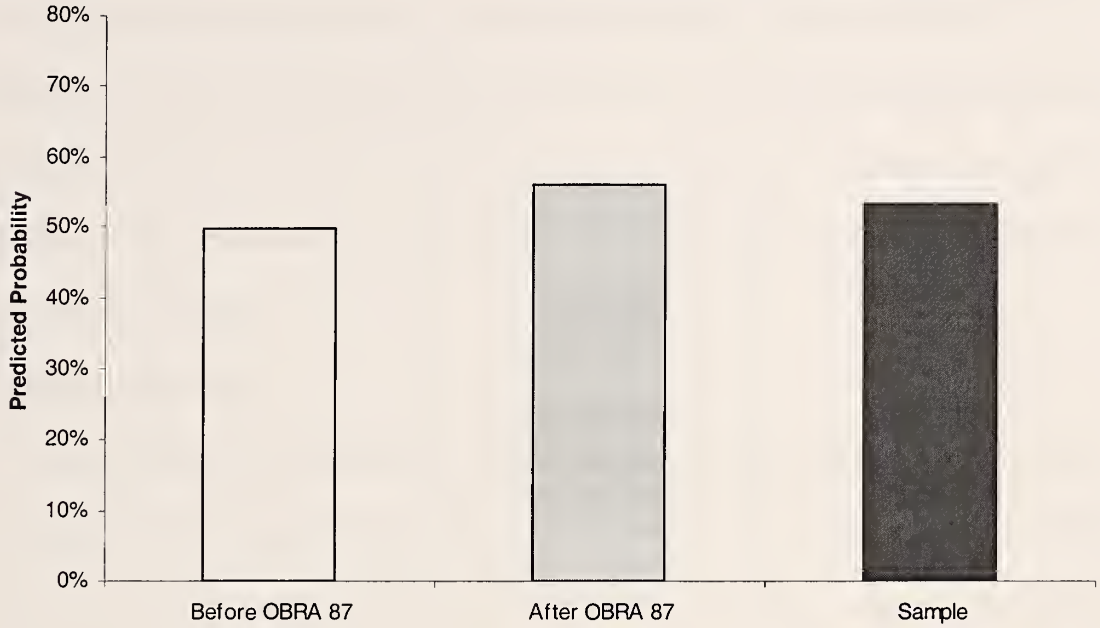
To simulate the effect of OBRA 87 regulation and other changes in the nursing home markets on the expected level of health severity of nursing home entrants, the OBRA 87 dummy variable is first set equal to zero and then it is set equal to one for all the observations. The results indicate that the average probability of an elderly person with past negative health outcomes changes from 49.7% before OBRA 87 regulation to 55.9% post OBRA 87 regulation (Figure 5.1). Therefore, on average, the probability increased by 6.2%. This simulation suggests that nursing homes are receiving more people with poor health status after the implementation of OBRA 87 regulation. Various studies found that over time, individuals with worse health status have been entering nursing homes. This trend can be attributed mainly to an increase in nursing home care alternatives and the government screening programs over time.

PERCENT MEDICAID RESIDENTS IN THE FACILITY (A PROXY FOR ACCESS TO NURSING HOME CARE FOR THE MEDICAID POPULATION)

OBRA 1987 Required Minimum Quality Standards

Simulations based on the percent Medicaid residents in the nursing home show that access to nursing home care declines a little following the implementation of OBRA 1987

Figure 5.1: Simulated Marginal Effects of OBRA 87 Regulation on the Predicted Probability of An Elderly Entering a Nursing Home with a History of Encountering Any of the Negative Health Outcomes Within Three Months Prior to the Current Admission



regulation. The average nursing home's predicted percentage of Medicaid residents falls from 51.3% before OBRA 1987 to 50.4% post OBRA 1987 (Figure 5.2).

These simulations suggest a trend towards reduced access for the Medicaid population due to increasing government quality enforcement standards, penalties and other requirements that may be increasing nursing home costs. Therefore, nursing homes that can not remain profitable or that see profits falling may be opting out of Medicaid contracts or reducing the Medicaid population, as these institutions are more attracted to the profitable private paying residents.

Market Demand Level

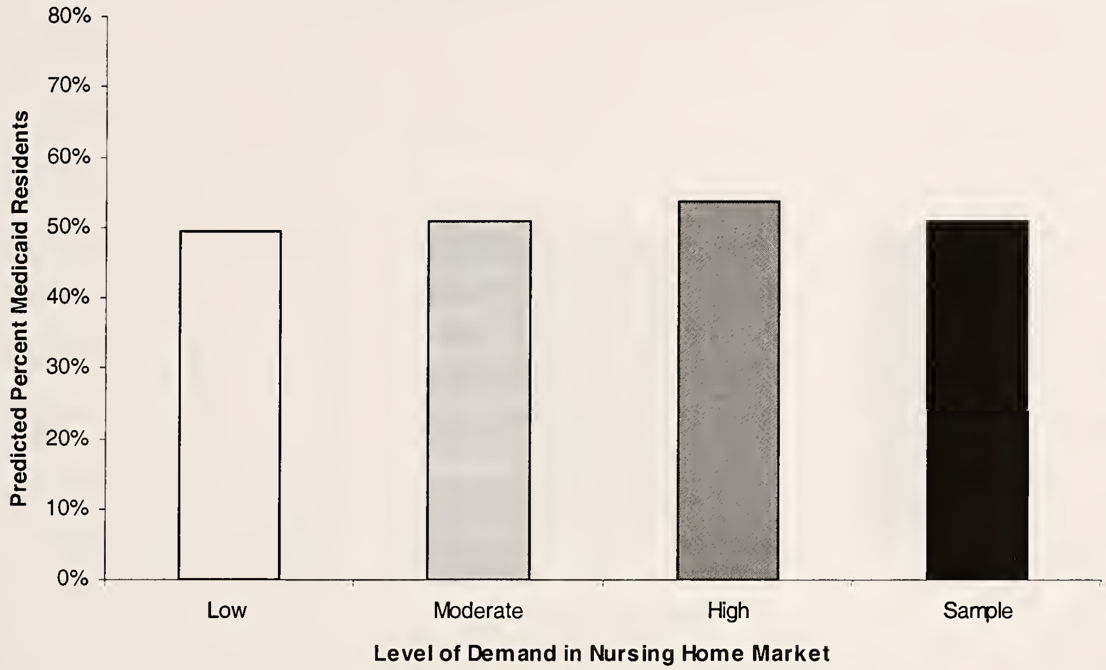
Results indicate that on average, access to care for the Medicaid population increases with an increase in market demand. The average nursing home's predicted percent Medicaid census increases from 49.3% in the low demand markets (occupancy rate < 0.83) to 53.7% in high demand markets (occupancy rate ≥ 0.93) (Figure 5.2).

These simulated results indicate that nursing homes are unable to find marginal Medicaid residents profitable due to an increase in the average cost as a result of excess capacity or an increase in the variable costs due to the nursing home's increased quality efforts to attract more prospective customers.

Competition

Simulations show an increase in access to care for the Medicaid eligible population as market competition increases. On the average, a nursing home's predicted percent Medicaid population increases from 50.2% in low competition markets (HHI > 0.10) to 51.6% in high competition markets (Figure 5.3). Also, the results indicate that an increase in the competition marginally increases access in the low demand markets by 0.5%, but the effect is

Figure 5.2: Simulated Effects of (1) Level of Demand in the Nursing Home Market and (2) OBRA 1987 Regulation on the Probability of the Percent Medicaid Residents in the Nursing Home



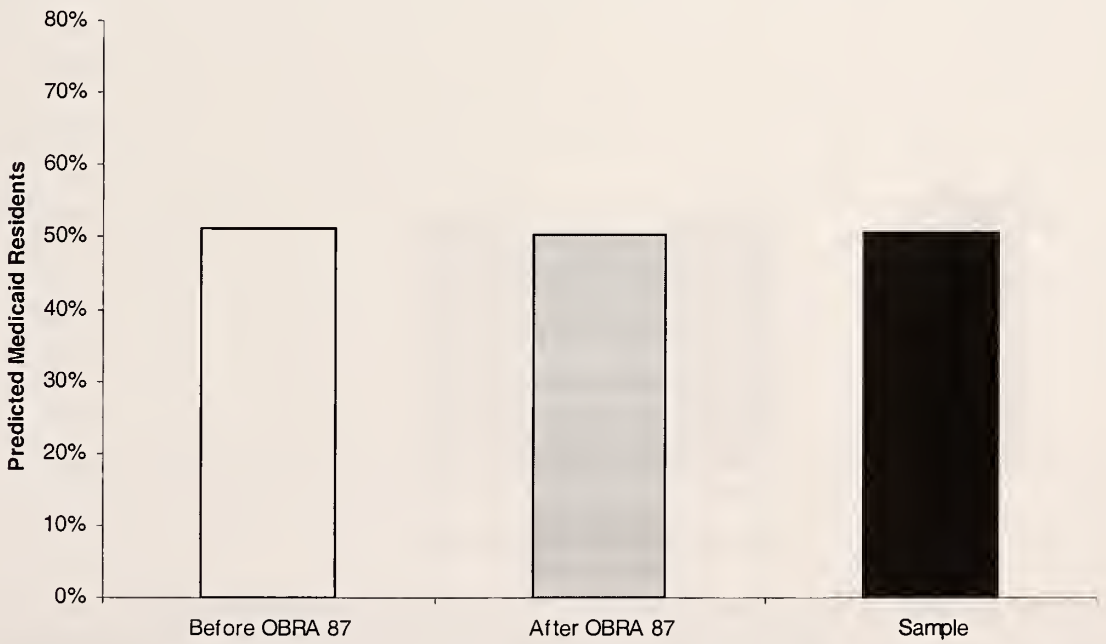
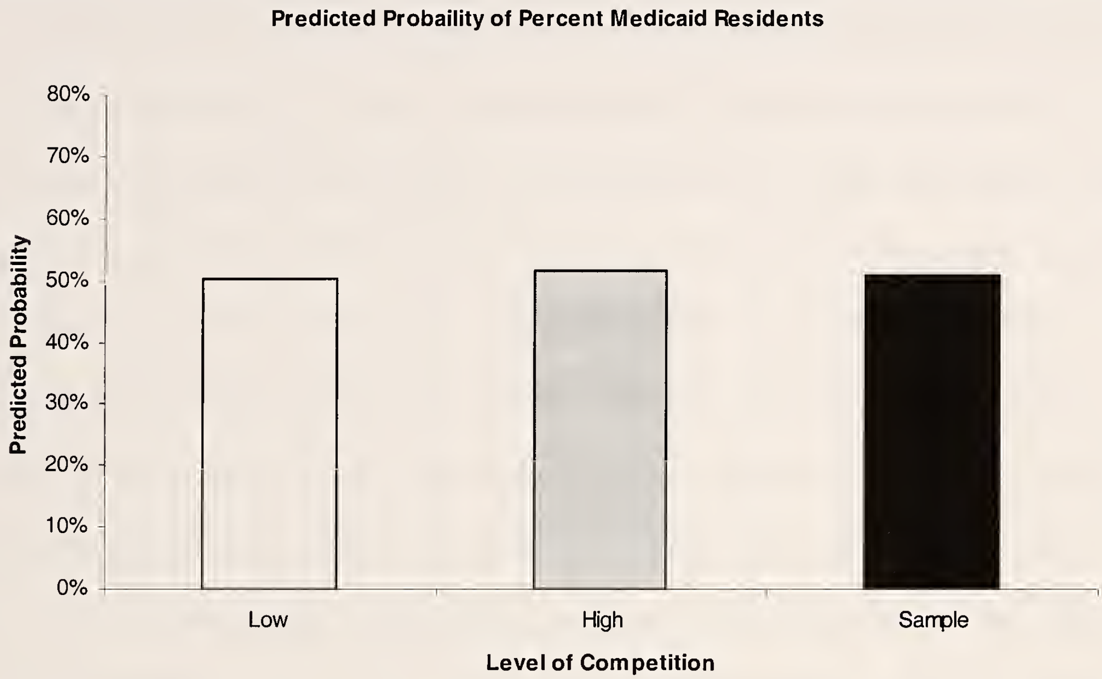
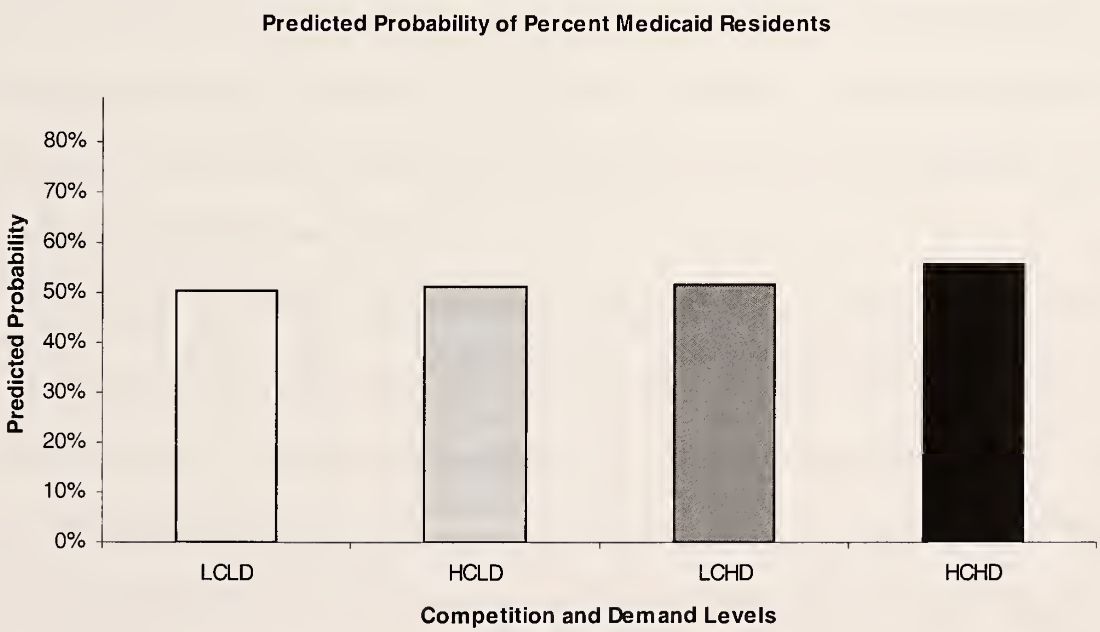


Figure 5.3: Simulated Effects of Competition (1) Alone and (2) With Market Demand Level on the Probability of Percent Medicaid Residents in the Nursing Home.





Note: LCLD=Low Competition and Low Demand, HCLD=High Competition and Low Demand, LCHD=Low Competition and High Demand and HCHD=High Competition and High Demand

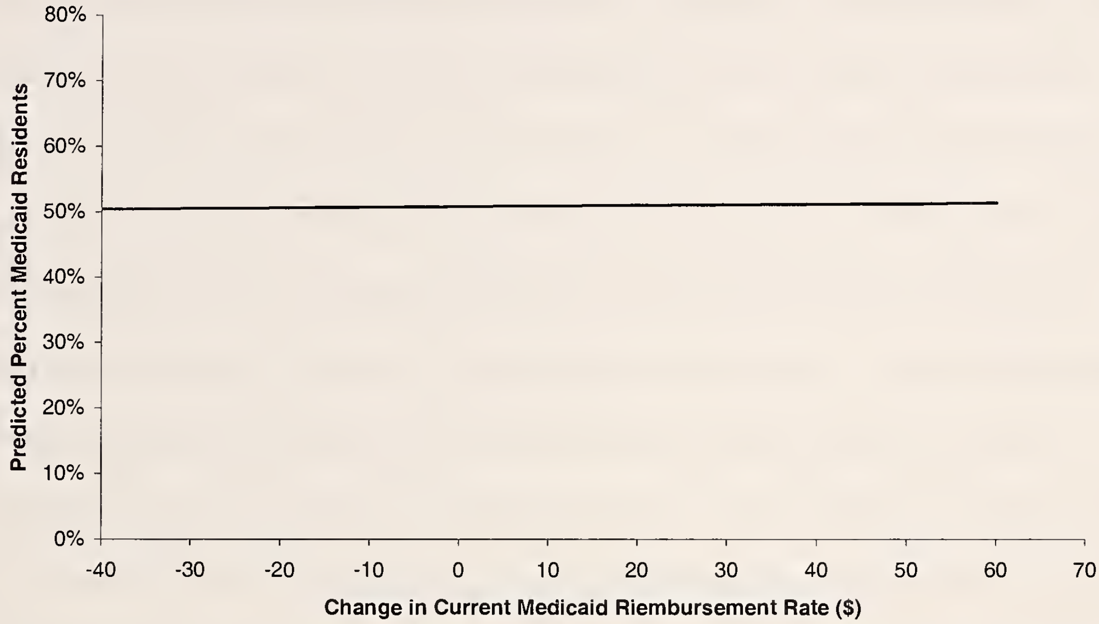
higher in the high demand markets (4.1%). Therefore, the marginal effect of competition in high demand compared to low demand markets is 3.6%.

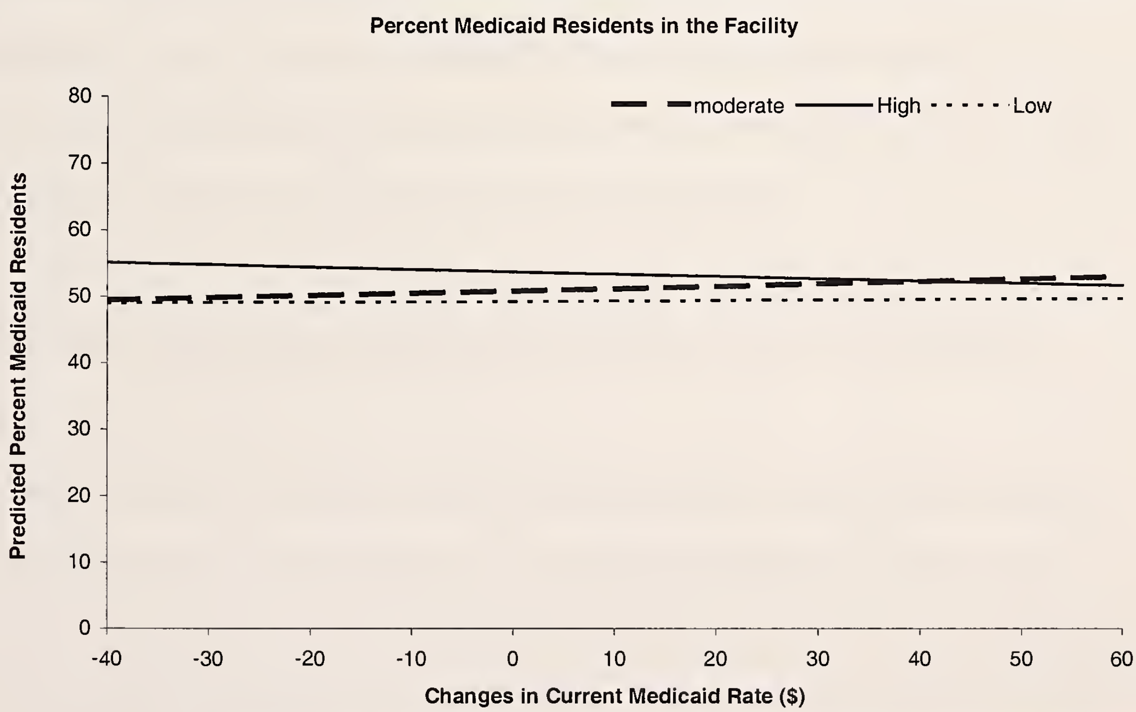
These simulation results are not surprising. In the low demand markets, the average cost of caring for a nursing home resident is already high due to higher overhead as a result of empty beds and a higher level of quality. In such markets, the nursing homes may be willing to add a few more Medicaid residents to prevent the overhead costs from going up as a result of losing some private residents to the increased competition. In addition, there may be fewer Medicaid-eligible potential nursing home residents as a result of past government efforts to ensure a network of nursing home alternatives. On the contrary, nursing homes in high demand markets have lower costs of care due to lower overhead as a result of full occupancy. In these markets, nursing homes will be more willing to substitute lost private residents with Medicaid residents, as this action will help them keep overhead costs low. Also, in such markets, government facing strained budgets from high nursing home costs may have contracted out these services to managed care providers. These providers are expected to exercise their power and force nursing homes to accept more Medicaid residents.

Medicaid Reimbursement Rate

To simulate the effect of Medicaid reimbursement rates, this analysis changes current Medicaid rate to between $40 less to $60 more and makes predictions for each change. On average, an increase in the Medicaid reimbursement rate increases nursing home care access for a Medicaid eligible person (Figure 5.4). This effect is not that substantial. For example, an increase of $55 improves access to care by 0.5% percentage points (i.e., the percent Medicaid residents increases from a current average of 50.8% to 51.3%). Further, the simulations indicate that an increase in Medicate rate affects the Medicaid population's

Figure 5.4: Simulated Effects of Changes in Medicaid Rate (1) Alone and (2) Interactively with Demand Level on the Percent Medicaid Residents in the Facility





access to nursing home care almost negligibly in the low demand markets, positively in the moderate demand markets and negatively in the high demand markets. A $55 increase in the Medicaid rate leads to, respectively, an average 2.1 percentage point increase, a 2 percentage point decrease, and a 0.4 percentage point increase in the percent Medicaid residents from the baseline level in moderate, high, and low demand markets. An increase in access for the Medicaid population seems to follow logically from an increase in the Medicaid rate; access increases when marginal potential Medicaid residents become more profitable than marginal private residents. Also, it is understandable that with decreasing demand, the additional gains in terms of access declines as the reimbursement rate increases. It may be that in these low demand areas, nursing homes find the additional gains of attracting the marginal Medicaid resident to be offset by the additional costs (e.g. quality enhancement costs). The only plausible reasons for a decrease in access with an increase in the Medicaid rate in high demand markets either that the government has encouraged prospective nursing home residents to use cheaper alternate care setting than nursing homes, the government has become more active and strict in enforcing quality standards and penalizing violators, or that the government has become more stringent in its screening efforts.

DEATH OUTCOME DURING FIRST SIX MONTHS STAY IN THE NURSING HOME

Simulations based on the model estimating the likelihood of an elderly dying within six months of admission to a nursing home provide an additional insight into quality of care.

Past Negative Outcomes

The average individual's predicted probability of dying rises from 14.9% if that individual does not have any negative health outcomes in the past to 21.6% if that individual has at least one past negative health outcome (Figure 5.5).

These results suggest a significant relationship between an individual's health before and death outcome after the admission. They may also point to the fact that studies that do not control for past health status may bias a nursing home's quality downward.

Percent Medicaid Residents in the Nursing Home

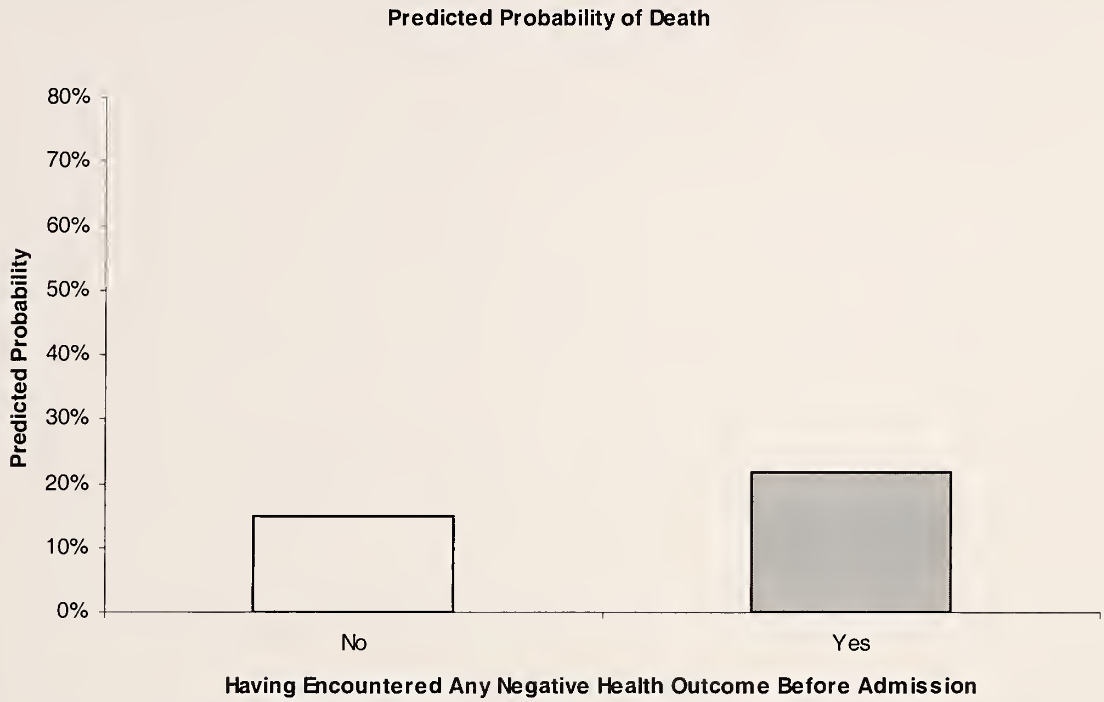
The findings need to be interpreted with caution as the relationship between the percent Medicaid residents and the death outcome is significant only at the 0.20 significance level. Results show that the likelihood of death declines as the percent Medicaid residents in the facility increases. The average elderly individual's predicted probability of dying within six months of stay ranges from 34.3% in the nursing home without any Medicaid resident to 7.8% in the nursing home with Medicaid residents only (Figure 5.5).

These results are not surprising for the following reasons: A nursing home is more likely to provide more routine, less skilled care as the percent Medicaid residents increase. A person in a nursing home requiring skilled care is more likely to die and is more likely to go into a nursing home with a lesser percentage of Medicaid residents.

OBRA 1987 Regulation

OBRA 1987 regulation has a substantial effect on the likelihood of an individual's death. On the average, an elderly person's predicted probability of death within six months of entering a nursing home falls from 23.0% before OBRA 1987 to 15.3% following OBRA 1987 implementation (Figure 5.6).

Figure 5.5: Simulated Effects of (1) Past Negative Outcomes and (2) Percent Medicaid Residents in the Facility on the Probability of Encountering Death Outcome in the Nursing Home



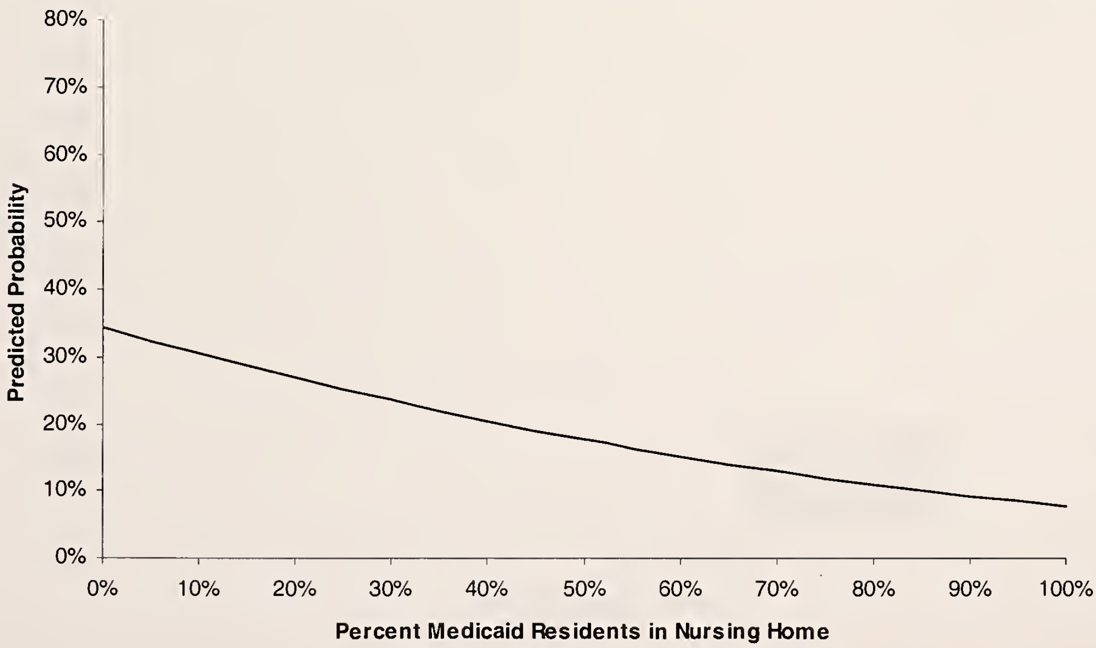
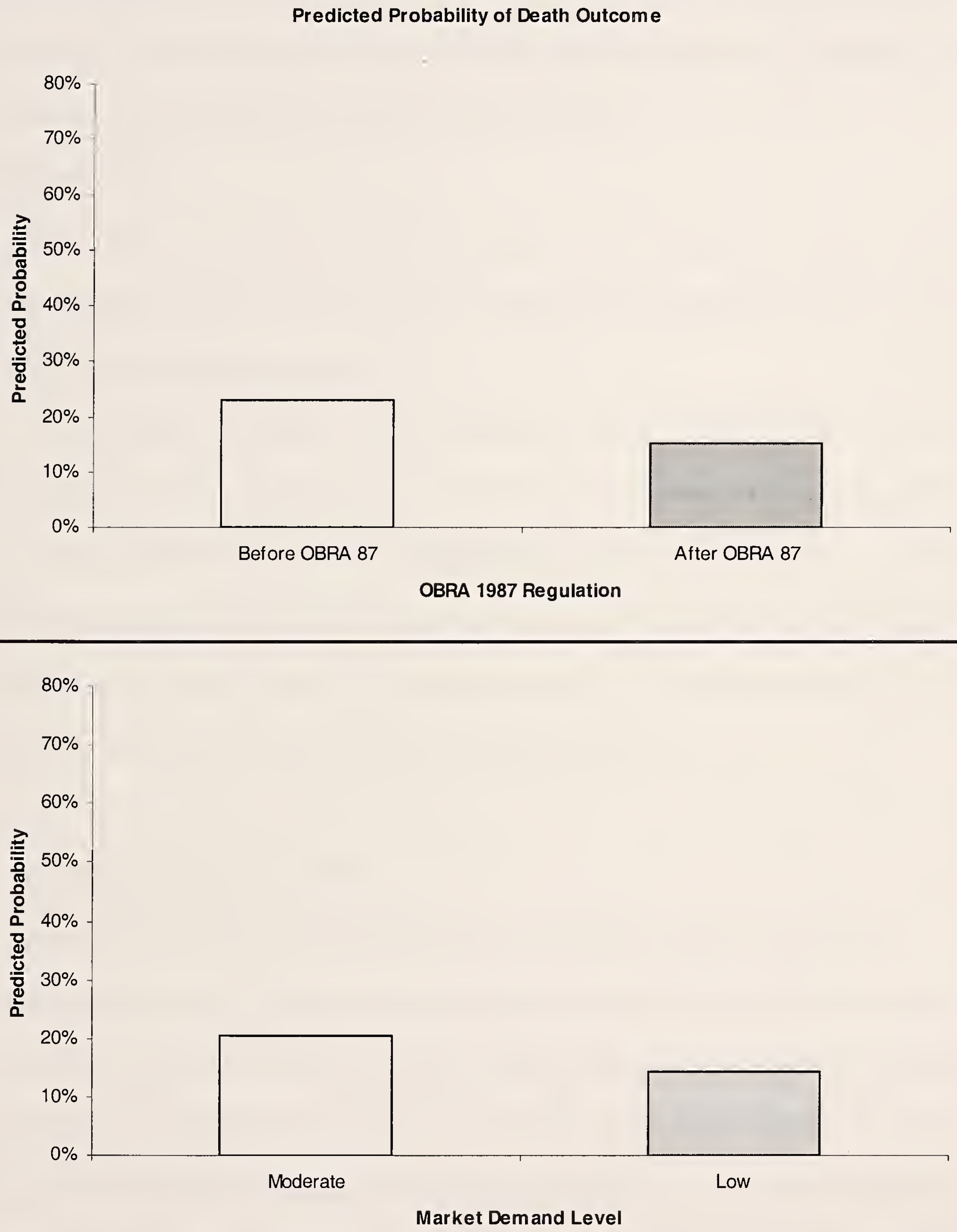


Figure 5.6: Simulated Effects of (1) OBRA 1987 Regulation and (2) Market Demand Levels on the Probability of Death Outcome Encountered in the Nursing Home



These simulations suggest that the regulation-required increases in the minimum quality standards contributed to an improvement in the quality of care that offset any reduction in the quality, as result of the transfer of resources from the other areas to meet these standards. This disproves the assumption made earlier in the theory that government-required minimum standards increase costs but do not improve quality of care.

Market Demand

An average elderly person's predicted probability of dying within six months of entering a nursing home declines from a high 20.6% in moderate demand markets to a low of 14.4% in low demand markets (Figure 5.6)

The simulation results seem rational and plausible. In low demand markets, competition among nursing homes to attract more residents from the community, other nursing homes and nursing home alternatives forces nursing homes to greatly improve quality. In addition, nursing homes need to improve the quality to prevent current residents from leaving the nursing home for better facilities. Such improvements in the nursing home quality may be reaching levels that have a positive effect on the death outcome.

Medicaid Reimbursement Rate

Results indicate that an individual's likelihood of death increases as the current Medicaid rate increases. It may be that nursing home tend to admit sicker residents as the Medicaid rate increases. An average elderly nursing home resident's predicted probability of death within six months of stay rises from 18.5% at the current Medicaid rates to 22.6 % if the rate is increased by $60 (Figure 5.7). Changes in the Medicaid per diem rate do not have a statistically significant differential effect with varying market demand for nursing home

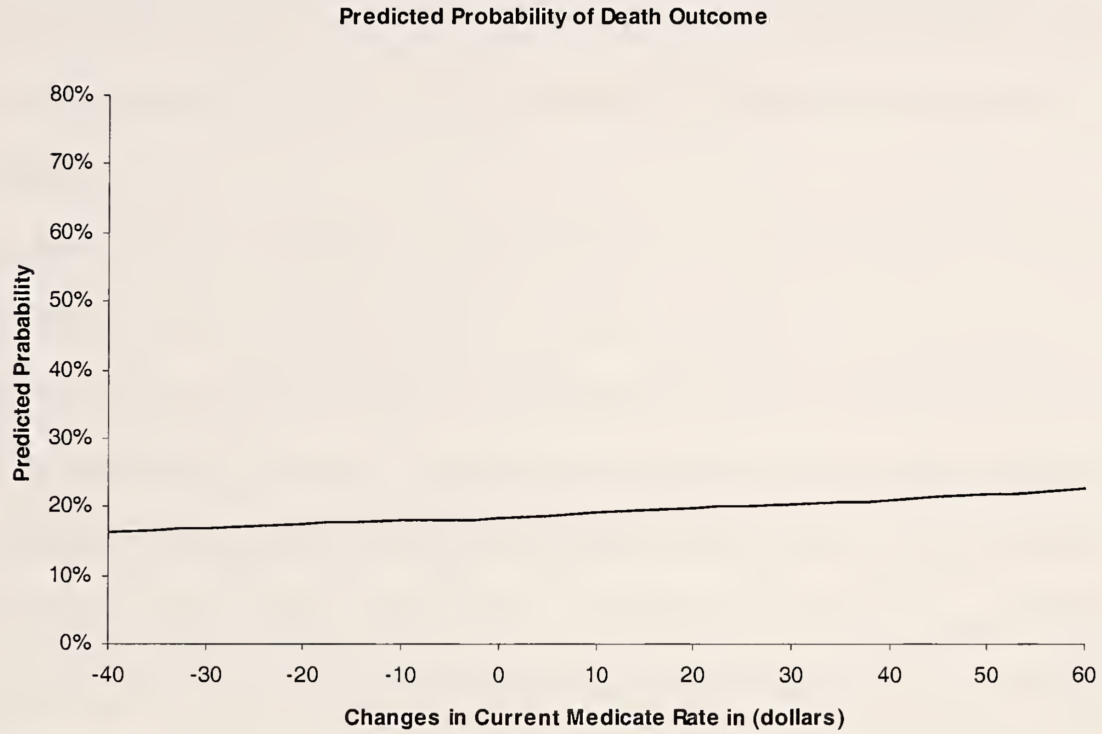
services on the risk of dying. Further, the simulations indicate that the predicted probability of an average person dying while staying in the nursing home increases only in the high and moderate demand markets but decreases in the low demand markets. For an increase in Medicaid rate of $60, the expected probability of an elderly person dying in the nursing home within six months of stay increases by 9 and 5 percentage points in the moderate and high demand markets respectively (Figure 5.7). But this probability falls by 3.5 percentage points in the low demand markets.

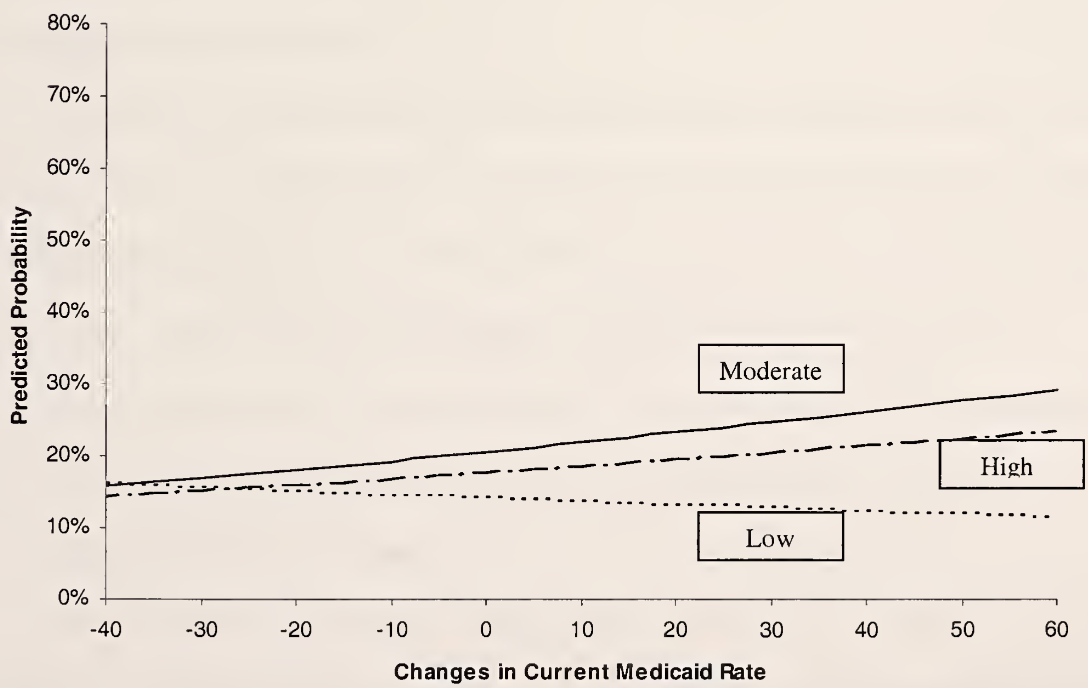
In high demand markets, the high demand basically reflects the Medicaid population. In such markets, the Medicaid covered elderly population may be so desperate to gain admission that they may not pay attention to quality aspects. Therefore, nursing homes in these markets do not consider quality a tool to attract the prospective Medicaid residents. With increases in the reimbursement rate, a marginal Medicaid resident is more profitable than a marginal private paying resident. Therefore, a utility maximizing nursing home will substitute a Medicaid resident for a private resident or admit additional residents covered by Medicaid. But this is not the case in low demand markets, where attracting additional Medicaid residents requires that a nursing home improve its quality. Therefore, given the current trend of increasing numbers of markets with low demand, it can be predicted that the death outcome in nursing homes is expected to fall over time.

CURRENT NEGATIVE HEALTH OUTCOMES

To gain insight on the effects of various market and policy changes on the likelihood of an individual experiencing negative health outcomes, simulations are performed using the negative health outcome FIML model.

Figure 5.7: Simulated Effects of (1: (1) Alone; (2) In Different Demand Levels on the Probability of Death Outcome Encountered in the Nursing Home





Percent Medicaid Residents in the Facility

The average individual's predicted probability of encountering any of the negative health outcomes within six months of entry increases from 3.4% in nursing homes with no Medicaid population to 76.8% in nursing homes with 100 percent Medicaid population (Figure 5.8).

These results are not surprising for the following reasons: As the percentage of Medicaid residents increases, lower Medicaid rates constrain a nursing home's ability to improve quality; and a nursing is more likely to provide routine care services and less skilled care as the percent Medicaid residents in a nursing home increases. Persons requiring skilled care are healthier on average than those requiring routine care due to higher ADLs and IADLs resulting from aging. These elderly people are more likely to encounter the negative health outcomes. Also, they are more likely to go into nursing homes with a higher percentage of Medicaid residents.

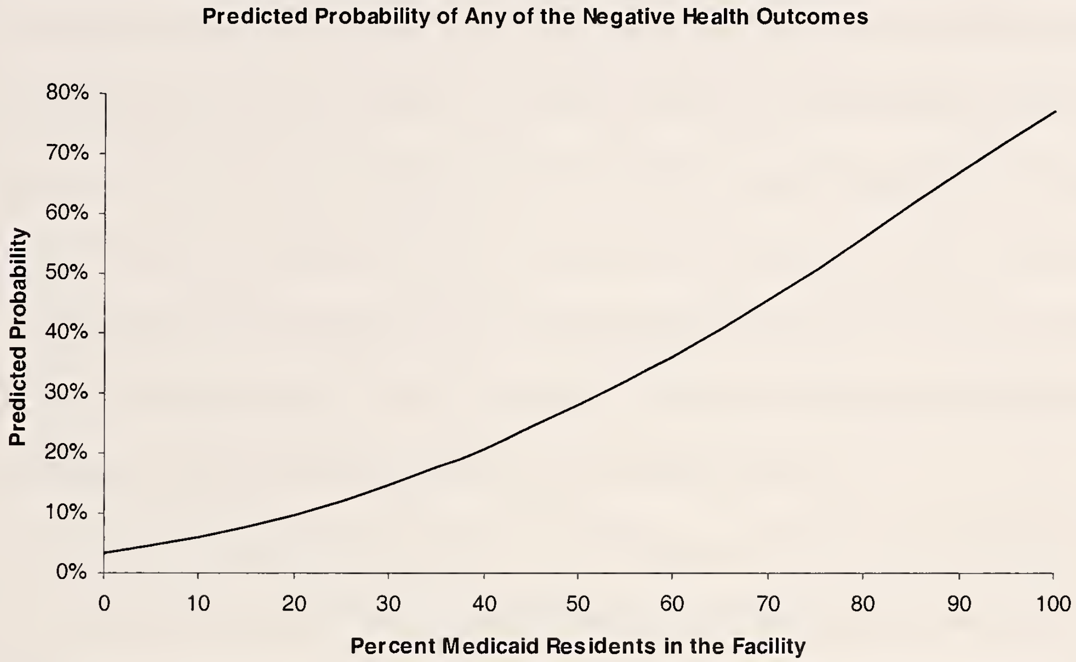
Past Negative Health Outcomes

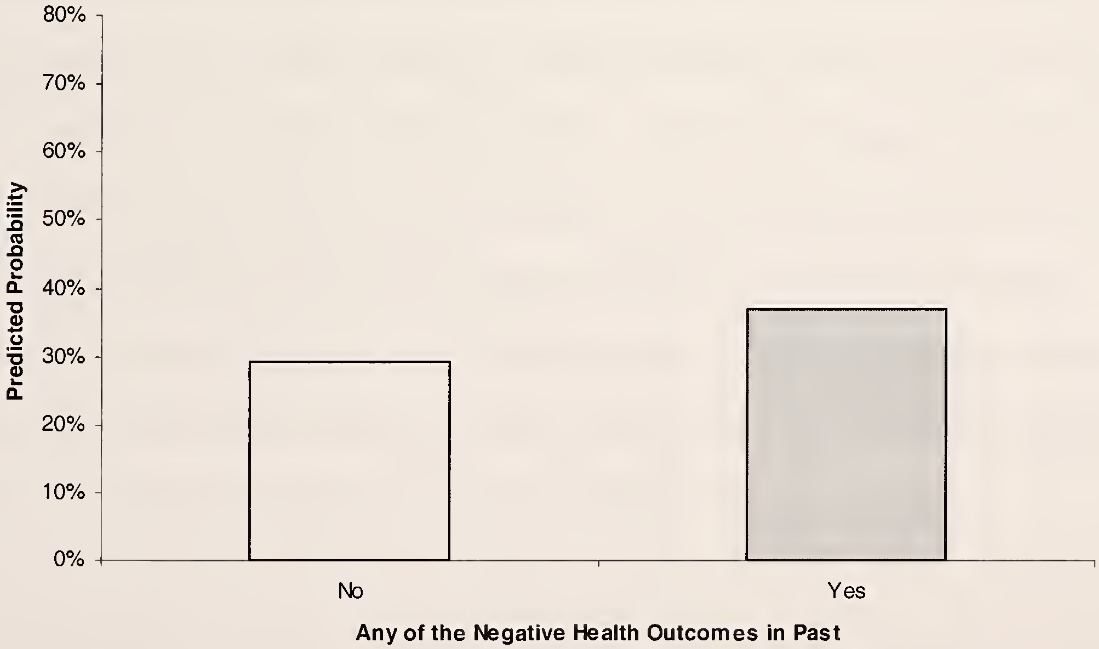
On average, an elderly person's predicted probability of encountering a negative health outcome within six months increases from 29.4% if that individual has no history of such outcomes before admission to 37% if that individual has a prior history of such outcomes (Figure 5.8). These simulation results suggest a significant relationship between an individual's health before and after the admission. It may also point to the fact that studies that do not control for past health status may bias nursing home quality downward.

Medicaid Reimbursement Rate

Results indicate that an average sampled individual's likelihood of negative outcomes insignificantly decreases as the current Medicaid rate increases. An average elderly nursing

Figure 5.8: Simulated Effects of (1) Percent Medicaid Residents in the Nursing Home and (2) an Individual Having Encountered Any of the Negative Outcomes Within Three Months Prior to Current Admission on the Probability of Any of the Negative Health Outcomes Encountered in the Nursing Home

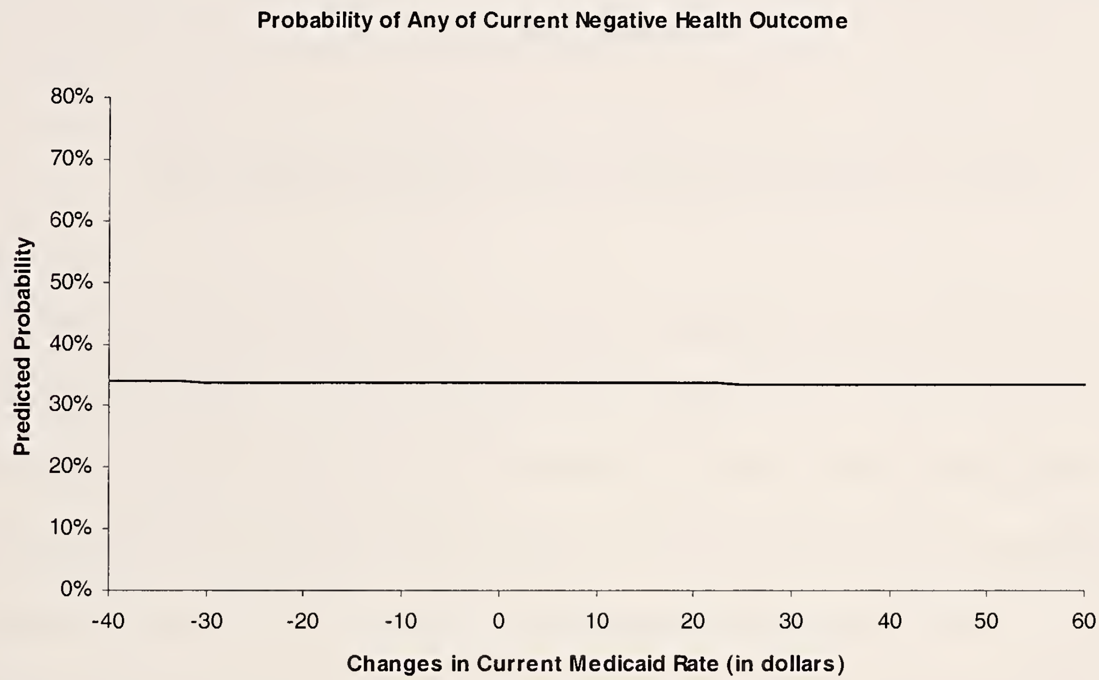


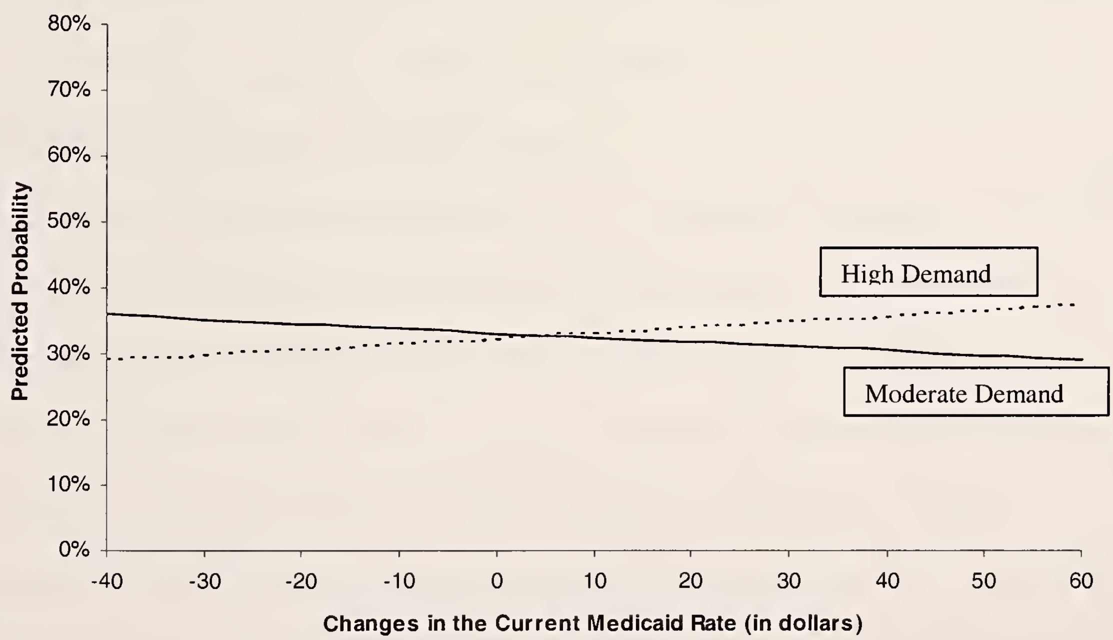


home resident's predicted probability of any of the negative health outcomes within six months of stay falls from 33.6% at the current Medicaid rates to 33.4% if the current Medicaid rate is increased by $60 (Figure 5.9). Further, the simulations indicate that the predicted probability of an average person encountering the negative health outcomes while staying in the nursing home increases in the high and decreases in the moderate demand markets. For an increase in the Medicaid rate of $60, the expected probability of an elderly person dying in the nursing home within six months of stay increases by 5 percentage points in the high demand markets (Figure 5.9). But this probability falls by 4 percentage points in the moderate demand markets. There is no effect of Medicaid reimbursement rate on the probability of dying in the nursing home in the low demand markets.

As noted above, high demand is basically the Medicaid population's high demand. In such markets, the Medicaid covered elderly population may be so desperate to gain admission that they may not pay attention to quality aspects. Therefore, nursing homes in these markets do not consider quality a tool to attract the prospective Medicaid residents. With increases in the reimbursement rate, a marginal Medicaid resident is more profitable than a marginal private paying resident. Therefore, a utility maximizing nursing home will substitute a Medicaid resident for a private resident or admit additional residents covered by Medicaid. But this is not the case in low demand markets, where attracting additional Medicaid residents requires that a nursing home improve its quality. Therefore, given the current trend of increasing numbers of markets with low demand, it can be predicted that the death outcome in nursing homes is expected to fall over time.

Figure 5.9: Simulated Effects of Medicaid Reimbursement Rate: (1) Alone; (2) In Different Demand Levels on the Probability of Any of the Negative Health Outcomes Encountered in the Nursing Home





CHAPTER SIX

DISCUSSION, POLICY IMPLICATIONS AND CONCLUSIONS

Results from this study demonstrate that policy, organization, market and individual characteristics influence the quality of and access to nursing home care for the Medicaid population. In addition, the analysis shows that the past health outcomes and the facility-specific payer mix are endogenous in the quality of nursing home care. Also, past negative health outcomes are endogenous in the percent Medicaid residents of the facility to which the elderly person gains admission. Further, this study finds that the FIML model produces results with the smallest standard errors among the three models considered in this study. This chapter discusses the policy implications of findings.

Negative Health Outcomes Prior to Admission

The results indicate that nursing homes are, on average, receiving more residents with a history of negative health outcomes (encountered within three months prior to admission) after OBRA 1987. This means that the average severity level in the nursing has increased after the implementation of OBRA 1987 required minimum quality standards, as shown by various studies (Bishop, 1999;Harrington et al, 1999). The analysis also suggests, as expected, that an individual with past negative health outcomes is more likely to encounter death or other negative health outcomes in the facility. Therefore, if studies analyzing the effect of any intervention or policy like OBRA 87 do not account for past health status, they

will bias the effect of intervention or policy downward. Further, studies linking poor quality of nursing home care with higher percent Medicaid residents will exaggerate this relationship upward if they do not accounting for an individual resident's past health status.

Percent Medicaid Residents in the Facility

The results indicate that facilities with proportionally higher percent Medicaid residents are more likely to provide poorer quality of care. Similar findings are found by other studies (Birnbaum et al., 1981; Schlenker and Shuagnessy, 1984; Nyman, 1988). This analysis controls for the market demand level and the Medicaid reimbursement rate. It may be that lower Medicaid per diem rate constrain the quality improvement efforts of nursing homes. Therefore, nursing homes become more restricted in improving quality as the percent Medicaid residents increases. In addition, it may be that the private-paying residents on average tend to be healthier, more resourceful and better educated than the Medicaid-eligible population. Besides this advantage, the private-paying residents are preferred by the nursing homes due to higher private price. Therefore, the private-paying elderly may be at an advantage when seeking admission to a nursing home with higher quality of care.

The large and significant effect of the facility-specific payer mix on the quality of care found in this study may be due to unaccounted facility-specific factors or this particular study sample specific. But it does indicate that there exist a strong relationship between facility-specific payer mix and the likelihood of residents' negative outcomes. Therefore, it may be that nursing home quality of care in terms of residents' health outcome can be improved by influencing the proportion of Medicaid residents directly as suggested by Norton (2000). Indeed, the government can use this policy instrument to improve quality without constraining its budget. To do so, the government needs to require that nursing homes have a

minimum level of payer mix of residents to be certified for payments from the Medicare and Medicaid programs. For example, Veterans' Administration hospitals are required to be attached to teaching hospitals (Norton, 2000).

OBRA 87 Required Minimum Quality Standards

The study findings indicate that OBRA 87 regulation reduced the Medicaid population's access to nursing home care, but improved the quality of such care. The quality is improved in terms of reduced risk of death in the nursing homes. The downward trend in the facility-level deficiency citations found by Harrington and colleagues (1999) from 1991 to 1997 further reinforce the positive effect of OBRA 87 regulation.

Competition

Competition among nursing homes seems to increase the Medicaid population's access to nursing home care in both high and low demand markets but the effect is more pronounced in high demand markets. In addition, competition from informal care providers reduces the likelihood of negative health outcomes and increases the likelihood of death.

Increased competition in low demand markets may force nursing homes to admit more Medicaid residents without improving the quality of care. This will enables nursing home to recoup overhead costs. But in high demand markets, a nursing home can always substitute lost residents with potential Medicaid residents. Thus, an increase in competition among nursing homes leads to greater access for Medicaid residents.

In summary, access for Medicaid population to nursing home care can be improved by increasing the competition among nursing homes. Competition from informal care providers has mixed effect on an individual's likelihood of encountering negative health outcomes.

Medicaid Reimbursement Rate

An increase in the Medicaid reimbursement rate in high demand markets seems to increase the risk of negative outcomes including death. It may be that nursing homes admit sicker residents at higher reimbursement rate. This study shows no evidence of any effect of Medicaid reimbursement rate on the likelihood of negative health outcomes in the low or moderate demand markets. Cohen and colleagues (1996) also do not find any effect of Medicaid reimbursement on the quality of nursing home care. But there is evidence that the likelihood of death increases in moderate demand markets. The risk of death declines with the Medicaid reimbursement rate in low demand markets. These results indicate that Medicaid reimbursement has a negative effect on quality in high demand markets and a positive effect in low markets, consistent with the findings of various studies (Nyman, 1985; Gertler, 1989; Reschovsky, 1996). Further, the results indicate a nonlinear effect of Medicaid reimbursement rate on access to nursing home care for the Medicaid population. In low demand markets, the Medicaid reimbursement rate has no effect on access for the Medicaid population. In moderate demand markets, access increases with the Medicaid reimbursement rate but decreases in high demand markets.

The study finding that higher Medicaid rate decreases access to nursing home care for the Medicaid population in high demand areas does not seem intuitive. Although the effect is very small, it still exists. The only plausible reasons for a decrease in access with an increase in the Medicaid rate in high demand markets either that the government has become more active and strict in enforcing quality standards and penalizing violators, or that the government has become more stringent in its screening efforts. The findings of improved access for the Medicaid population in moderate demand markets seems reasonable, as the

marginal costs may be lower than the marginal revenues. In low demand markets, the Medicaid rate may not be effective in improving access due to already high marginal cost of care. In such markets, nursing homes may be maintaining higher quality to prevent losing potential residents to alternate care settings as well as to keep intact current residents. Therefore, if the Medicaid rate does not increase significantly to cover this high marginal cost of care, it is highly unlikely that a nursing home is going to admit additional Medicaid residents.

In summary, this study indicates that OBRA 87 required outcome-oriented quality standards can be used to assess the quality of nursing home care. This study indicates the positive effects OBRA 87 in terms of reduced death outcomes on the nursing home quality of care. The full intended potential of OBRA 87 regulation can be achieved by including all the outcomes that can be improved through better care, such as bedsores, urinary tract infection, falls, malnutrition, dehydration and others in the survey list as the important markers to assess quality of care.

In addition, this study provides insight into how individual outcomes like bedsores, dehydration can be used as a good measure of quality of care. Given the fact that HCFA has mandated that all government-certified nursing homes to provide individual-level data online using residents' assessment instrument, using an analysis similar to this study, quality problems at the nursing home level can be detected by comparing the predicted vs. observed health outcomes of residents in the facility. This information can help surveyors use available resources efficiently in enforcing the government standards.

The study shows that competition improves quality of and access to care for the Medicaid population. Also, the study suggests that access to nursing home care can be

improved by enhancing competition among nursing homes without affecting the quality of care.

Finally, the results indicate that any improvement in Medicaid reimbursement beyond the increases in the cost of inputs negatively affects negative health outcomes as well as access to nursing home care for the Medicaid population in high as well as moderate demand markets. Overall, it seems that increasing in the current Medicaid rate is not a beneficial policy tool to improve the quality of and access to nursing home care for the Medicaid population.

LIMITATIONS OF THE METHODOLOGY

The analysis does not ignore first few weeks after admission. Ignoring the first few weeks after the admission may have helped in minimizing the spillover effects of past health conditions. This is a limitation of this study. However, an attempt has been made in the analysis to minimize the spillover effects of past health conditions. The analysis includes only those individuals who did not have any of the studied outcomes at the time of admission. Outcomes like bedsores, injuries related to falls, urinary-tract infection, dehydration and malnutrition, if they exist, would be detected at the time of admission. There is a chance that the weight loss may go undetected but the likelihood of such cases is expected to be low. There is a chance that some unobserved person-specific factors may be associated with that person's likelihood of having a negative health outcome during nursing home stay. The technique employed in this analysis controls for person specific unobserved factors. In addition, the analysis controls for various person-specific health conditions prior to observed nursing home admission. Therefore, any negative outcomes detected during a

person's stay in the nursing home can be attributed to the quality of care in that nursing home.

This study uses Medicare Part A and Part B administrative data to determine sampled individuals' length of stay and health outcomes. Determining length of stay and health outcomes using this data can be problematic especially for people whose nursing home stays are not covered by Medicare. Use of physician visits to construct length of stay is limited by the fact that physicians do not visit the nursing home every month. This may lead to an under-estimation of actual stay by one month. But given the fact that this procedure did not under-estimate length of stays systematically, the results will not be affected. In addition, Medicare claims data are less complete prior to 1991 which may have biased the effect of OBRA 87 on the quality of care downward. Further, some unobserved individual specific factors that affect an individual's health status prior to admission in the nursing home may influence that individual's likelihood of encountering negative health outcomes. Health conditions like diabetes, Parkinson's disease, cardiovascular diseases, dementia, alziemer disease or hypertension developed prior to a nursing home admission may be endogenous in the system of equations used in the analysis. For example, there may be some unobserved individual-specific factors that may be correlated with an individual's likelihood of developing disease like diabetes, Parkinson's disease or hypertension. Same individual's specific factors may be correlated with that individual's risk of encountering negative health outcomes in a nursing home. If these health conditions are correlated with the factors like Medicaid reimbursement rate or OBRA 1987 of interest in this study, the estimated direct effects of these factors of interest on the quality are going to be biased. This study does not account for this fact.

The results of this study can be generalized to the larger US population. The individuals sampled in this study are from the National Long-term Care Survey, a longitudinal survey conducted by the Department of Demographic Studies at Duke University. In addition, some individual and facility characteristics in the sample match the characteristics of elderly individuals sampled in a study that used HCFA's evaluation data examining the impact of implementing the Congressional mandated Resident Assessment Instrument (RAI)-The Minimum Data Set (MDS) (Intrator et al., 1999). For example, the mean age of the sample in their study is 81 years and the mean age in this study is 81.44 years. The HCFA study had 72.3% for-profit nursing homes and there are 65% for-profit nursing homes in this study. Their sample had 75% females and this study includes 67.4% females. Therefore, it can be concluded that this study sample represents the national population of elderly persons admitted to nursing homes.

STUDY CONTRIBUTIONS

The contributions of this study to the existing literature are listed below:

1. Previous studies have mainly focused on regulatory violations, costs, input intensity and structural attractiveness as measures of nursing home quality of care. Very few studies used health outcome measures of quality. Most of these studies used outcomes at facility or market levels. Measuring outcomes at such an aggregate levels poses two problems. First, the outcomes at a facility level may be representing overall case-severity of residents and not health outcomes. Second, aggregation to the facility level reduces variation, which dilutes the estimation. This study uses individual resident's health outcomes after accounting for initial health status. In addition, this study uses a large

number of outcome measures, so its results are expected to provide a good measure of quality of care.

2. In the past, most of the findings on quality of care were based on either a nationally representative cross section or a longitudinal study of a small segment of the elderly population. This study, on the other hand, uses a longitudinal survey (1984 to 1994) of a nationally representative sample of Medicare beneficiaries. Thus, the results of this study will be applicable to a wider range of the elderly population and can demonstrate changes and effects that take place over time.
3. This study uses Medicare part A and B claims, and OSCAR data that further improve the amount of information that is utilized to examine the relationship between quality and other covariates such as competition and demand. Also, this study uses facility, market and individual data to examine their relationship with nursing home quality of care. The outcome measures are based on physicians claims, hospital claims, and emergency room visits, and thus represent actual outcomes and not just reported outcomes that may be biased due to recall problems and biases.
4. Past study results may have been biased by the endogenous nature of resident mix at the facility level in the outcome equation. This study accounts for the endogeneity of nursing home level payer mix in the outcome models. The technique used in this study provides results as robust as any other technique if the error distribution assumptions imposed by other techniques are correct. If assumptions of other techniques are not correct, then the discrete technique provides less biased results than any other technique.
5. Past studies do not account for individual-level and market-level time-invariant heterogeneity due to common unobservable factors that affect a nursing home's decision

about the level of quality to be delivered and the proportion of Medicaid residents to be admitted.

CONCLUSIONS

This study suggests that the full-information maximum likelihood discrete factor method provides better estimates than two-step methods. The results indicate that OBRA 87 regulation improved quality of care but marginally reduced access to nursing home care for the Medicaid population.

The results indicate that the Medicaid rate may not be a cost effective policy tool for improving both quality and access to nursing home care for the Medicaid population. Increases in Medicaid rate reduce quality of as well as access to nursing home care for the Medicaid population. In low demand markets, it marginally increases quality of care but does not affect access to nursing home care for the Medicaid population. Simulations indicate that the government can improve quality of nursing home care by requiring nursing homes to have at least a minimum level of payer mix for Medicare and Medicaid certification. The results also indicate no significant effect of competition among nursing homes on the quality of care. But this competition does improve access to nursing home care for the Medicaid population.

APPENDIX

OBRA 1987 REGULATIONS

(PUBLIC LAW 100-203—DEC. 22, 1987

Subtitle C—Nursing Home Reform)

Quality of Life:

A nursing facility must care for its residents in such a manner and in such an environment as will promote maintenance or enhancement of the quality of life of each resident.

Quality Assessment and Assurance

Each facility must have a quality assurance committee, consisting of the director of nursing, a physician designated by the facility, and at least three other members of the facility's staff. This committee meets at least quarterly to identify issues with respect to which quality assessment and assurance activities are necessary and develops and implement appropriate plans of action to correct identified quality deficiencies.

Scope of Services and Activities under Plan of Care

A nursing facility must provide services to attain or maintain the highest practicable physical, mental, and psychological well-being of each resident, in accordance with a written plan of care which describes the medical, nursing, and psychosocial needs of residents and how such needs will be met. This plan is initially prepared with the participation to the extent practicable of the resident or the resident's family or legal representative.

Residents' Assessment

Assessment of each resident's functional capacity needs to be comprehensive, standardized, and reproducible.

Certification

Each assessment must be conducted or coordinated by a registered professional nurse who signs and certifies the completion of the assessment. Everyone involved in the assessment must sign and certify the accuracy of that portion of the assessment.

Penalty for Falsification

Any willful or intentional false assessment will be subject to civil penalties of not more than $3,000 with respect to each assessment. If a state detects that there has been false assessment, it can require reassessment of the residents by individuals who are approved by the state and are independent of the facility.

Frequency

Residents' assessment needs to be done promptly upon admission, after a significant change in the resident's physical or mental condition, and in no case less often than once every 12 months. Residents need to be examined no less frequently than once every 3 months.

Requirements Relating to Preadmission Screening for Mentally Ill and Mentally Retarded Individuals

A nursing facility must not admit any new resident who is mentally ill or retarded unless the State mental health authorities has determined prior to admission that the individual requires the level of services provided by a nursing facility or if the individual

requires such level of services, whether the individual requires active treatment for mental illness or retardation.

Provision of Services and Activities

A facility must provide nursing, other specialized rehabilitative services, medically-related social services, pharmaceutical services, dietary services, and an on-going program of activities to meet the interests and the physical, mental, and psychosocial well-being of each resident. It should also provide routing and dental services to meet the needs of each resident.

Qualified Persons Providing Services

Required Nursing Care

A facility must provide 24-hour nursing services which is sufficient to meet nursing needs of its residents and must employ the services of a registered professional nurse at least 8 hours a day for 7 days of the week. In special circumstances, this requirement of a registered professional nurse employed more than 40 hours a week may be waived by the secretary.

Required Training of Nurse Aides

A nursing facility must not use any individual who is not a licensed health professional for more than 4 months unless the individual has completed a training and competency evaluation program and is competent to provide such services. If an individual acquired a training and competency evaluation prior to last two years and has not performed nursing or nursing related services for monetary compensation within last two years, such individual is required to complete a new training and competency evaluation program. Nursing facilities

must have a regular performance review and training programs to ensure that individuals used as nurse aides are competent to perform such work.

Physician Supervision and Clinical Records

Medical care needs to be provided under the supervision of a physician. Facility must ensure the availability of a physician to provide necessary medical care in case of emergencies. Facility must maintain clinical records on all residents.

Required Social Services

Facilities with more than 120 beds are required to have at least one qualified full time social worker.

Requirements Relating to Residents' Rights

A skilled facility must protect and promote the rights of each resident. The right to choose a personal physician, to be fully informed in advance about care and treatment, to be fully informed in advance of any changes in care or treatment that may affect the resident's well-being and to participate in planning care and treatment or changes in care and treatment. The right to be free from physical or mental abuse, corporal punishment, involuntary seclusion, and any physical or chemical restraints that are not required to treat the resident's medical symptoms.

A resident has a right to privacy with regard to accommodations, medical treatment, written and telephonic communications, visits, and meetings of family and of resident groups. A resident has a right to confidentiality of personal and clinical records. A resident has right to voice grievances with respect to treatment or care that is furnished without discrimination or reprisal for voicing the grievances.

The right of the resident to organize and participate in resident groups in the facility and the right of the resident's family to meet in the facility with the families of other residents in the facility. Residents can participate in social, religious, and community activities that do not interfere with the rights of other residents in the facility. The residents can examine the most recent facility survey conducted by the government and any plan of correction in effect with respect to the facility. Facility is expected to inform residents about their rights orally and in writing at the time of admission to the facility. In case of an incompetent resident, a person responsible for the residents will be informed about these rights.

A nursing facility must permit each resident to remain in the facility and must not transfer or discharge the resident from the facility unless it is important for the resident's welfare, safety and health or a resident failed to pay an allowable charge after a reasonable and appropriate notice or the facility ceases to operate. The resident or his legal representative needs a thirty days notice in advance of transfer or discharge along with the reason for this action.

A nursing facility must permit immediate access to any resident by any representative of the Secretary, State, an Ombudsman or the resident's physician. Permit access to a resident by family members, relatives or individuals providing social, legal or other services to the residents subject to resident's consent.

Nursing facilities must establish and maintain identical policies and practices regarding transfer, discharge, and covered services regardless of source of payment. A facility can not require individuals to waive their rights to Medicare and Medicaid benefits. It can not require individuals to provide a third party guarantee of payment to the facility as a condition of admission to, or continued stay in the facility. A nursing facility will not solicit, charge,

accept any gift, money and donation above and beyond required to be paid under the State plan as a precondition of admitting or continuing providing services from an individual eligible for Medicaid benefits.

Before a resident of a nursing facility is transferred for hospitalization or therapeutic leave, a nursing facility must provide written information to the resident and an immediate family member or legal representative concerning the period during which the resident will be permitted to return and resume residence in the facility, and the policies of the facility regarding such absence.

A nursing facility must protect residents' funds and will not deposit such funds in any income generating resources. Upon a resident's death, a facility must inform the individual administering that resident's estate about the funds held in the facility. A facility can not impose charges against these funds for services covered by Medicare or Medicaid.

Use of Psychopharmacologic Drugs

Psychopharmacologic drugs may be administered only on the orders of a physician and only as part of a plan designed to eliminate or modify the symptoms for which the drugs are prescribed and only if, at least annually an independent, external consultant reviews the appropriateness of the drug plan of each resident receiving such drugs.

Requirement Relating to Administration and Other Matters

A nursing facility is required to provide the state agency responsible for the licensing of the facility about any change and of the identity of each new person, company, or individuals who administer, manage or own the facility.

A nursing facility must have been licensed under state and local laws, and must abide be the Life Safety Code of the National Fire Protection Association. A facility must establish and maintain an infection control program to provide a safe, sanitary, and comfortable environment to live and to help prevent the development and transmission of disease and infections. It must be designed, equipped, constructed, and maintained in a manner to protect the health and safety of residents and other public. A nursing facility must be in compliance with Federal, State, and local laws and professional standards and principals, which apply to professionals providing services in such a facility.

State Requirements Relating to Nursing Facility Requirements

The State must specify training and competency evaluation programs set forth in this regulation. The State shall establish and maintain a registry of all individuals who have satisfactorily completed a nurse aide training and competency evaluation program. In the registry, the State must include the history of any misconduct or other charges against any individual registered in the registry along with the state findings on these charges. The State must maintain a fair mechanism for hearing appeals on transfers or discharge related disputes. The State must have implemented and enforced the nursing facility administrator standards. It should also specify the instrument to be used to assess residents' health and well being.

Costs of Meeting Requirements

Reimbursement rates should be adjusted to accommodate reasonable costs incurred by the facilities in complying with the requirements of this regulations e.g. nurse aid training and competency evaluation programs.

Survey and Certification Process

Each State shall be responsible for certifying the compliance of nursing facilities with Federal and State requirements. Each State shall conduct periodic educational programs for the staff and residents of nursing facilities in order to present current regulations, procedures, and policies. The State shall be responsible for the investigations of allegations of residents' neglect, abuse and misappropriation of resident property. Each facility, which is found under a standard survey to have provided substandard quality of care, shall be subject to an extended survey. The extended survey shall be conducted immediately after the standard survey. Each State and the Secretary shall implement programs to measure and reduce inconsistency in the application of survey results. Surveys shall be validated with an onsite survey of a representative sample of nursing home residents within 2 months of the date of standard survey conducted by the State.

Remedies For Substandard Performance

If it is found that a State has failed to perform surveys as required under the law or that a State's survey and certification performance is not adequate, the Secretary shall provide appropriate remedy, which may include the training of survey teams in the State. Each State and the Secretary shall make available to the Public the results of the surveys including statements of deficiencies and plans of corrections. Even the cost reports and statements of ownership will be made available to the Public. If a nursing facility is found to be providing a substandard quality of care, the State shall notify the attending physician of each residents, and the State Medicaid fraud and abuse control unit. Each nursing facility is required to post the survey results in a place easily accessible to patients and patients' representatives.

Enforcement Process

If a State finds based on extended surveys that a nursing facility no longer meets Federal and State requirements, and further finds that the facility's deficiencies do or do not immediately jeopardize the health or safety of its residents, the State shall recommend to the Secretary to take appropriate action. If a State finds that a nursing facility meets the government requirements this survey time but as of a previous period, it did not meet the requirements, the State may recommend a civil money penalty specified in the law for the days in which the facility was not in compliance with such requirements.

Specified Remedies

The Secretary may deny any further payments with respect to all individuals entitled to Medicare and Medicaid benefits or with respect to such individuals admitted to the facility after the effective date of findings. Monetary penalties may be imposed up to $10,000 for each days of noncompliance. Temporary management may be appointed to oversee the operation of the facility while there is an orderly closure of the facility or improvements are made in order to bring the facility into compliance. In certain cases, it may be that Medicare and Medicaid payments may be made for a maximum of six months even if a facility is not in compliance with the government requirements. If a facility is found to be out of compliance on three successive surveys, a nursing facility shall be denied payments and it will be monitored until it is in compliance with the requirements of Federal and State laws. If a nursing facility has not complied with laws and that failure immediately jeopardizes the health or safety of its residents, the Secretary shall take appropriate actions immediately. In such a case, if the facility's participation in Medicare and Medicaid programs is terminated,

the State shall provide for the safe and orderly transfer of the residents affected by such action.

State Requirement for Preadmission Screening and Resident Review

The State must have in effect a Preadmission screening program for making determination for mentally ill and retarded individuals who are admitted to nursing facilities. The State must annually review and determine based on the evaluation conducted by a person or entity other than the State mental health authority whether or not the resident should continue to stay in the nursing facility or should go to the appropriate care providers.

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